Editorial

THE rate at which the art of radio is advancing today is so great that engineers and merely interested laymen alike are often seized with a wild despair at the thought that so much is passing them by too quickly to be absorbed or even observed.

Not so many years ago, the sum total of the average engineer's working data was less than that required of the advanced technical student or live-wire laboratory assistant. Radio in its infancy was a comparatively simple affair, or so it seems today, the branches of which spread out in many directions, but none very far removed from basic theory which served as inspiration and background.

Among those sadly aware of their shortcomings in keeping abreast of the rapidly moving scene are your humble servants who strive to keep our magazine up to date, and to cover as best they can the complicated array of subjects whose numbers are being expanded every day.

It was with a great deal of pleasure and encouragement therefore, that we listened to the sincere congratulations of a faithful reader who recently gave us high marks for our efforts to pick the highlights of what goes on round us.

At the same time, I know only too well how much of radio is still left untreated in our columns simply because there is just not enough time and space to deal with them. And therefore, although we are pleased that at least one of our readers is happy with our efforts, we do not commit the error of imagining there is not still more to be done, or further fields to conquer.

During the next twelve months, we have yet further fields to tackle, which include the vast subject of television, and FM broadcasting which goes with it. So far we have endeavored to break the ground for them by including a series of articles on television, and constructional articles on FM as well as much theoretical matter.

It now seems as though we must pass from the paper work to the work bench, and see what can be done from a more practical angle. One thing is clear, however, and that is that you, as readers, must face both these new developments with the same enthusiasm as your fathers brought to much simpler matters.

Rest assured, we'll do our best to see that together we will extract from the future the same profit and pleasure as we did from the past.

John Moyle

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RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

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VOL. 12 No. 7

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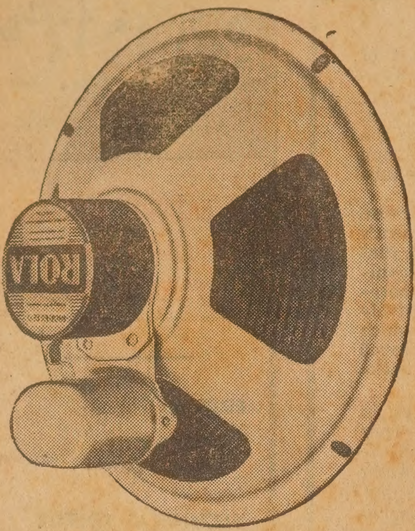
OUR COVER PICTURE

Portable operation has always been popular with amateurs, particularly on the ultra-high frequencies. The handie-talkie shown here is detailed elsewhere in this issue.



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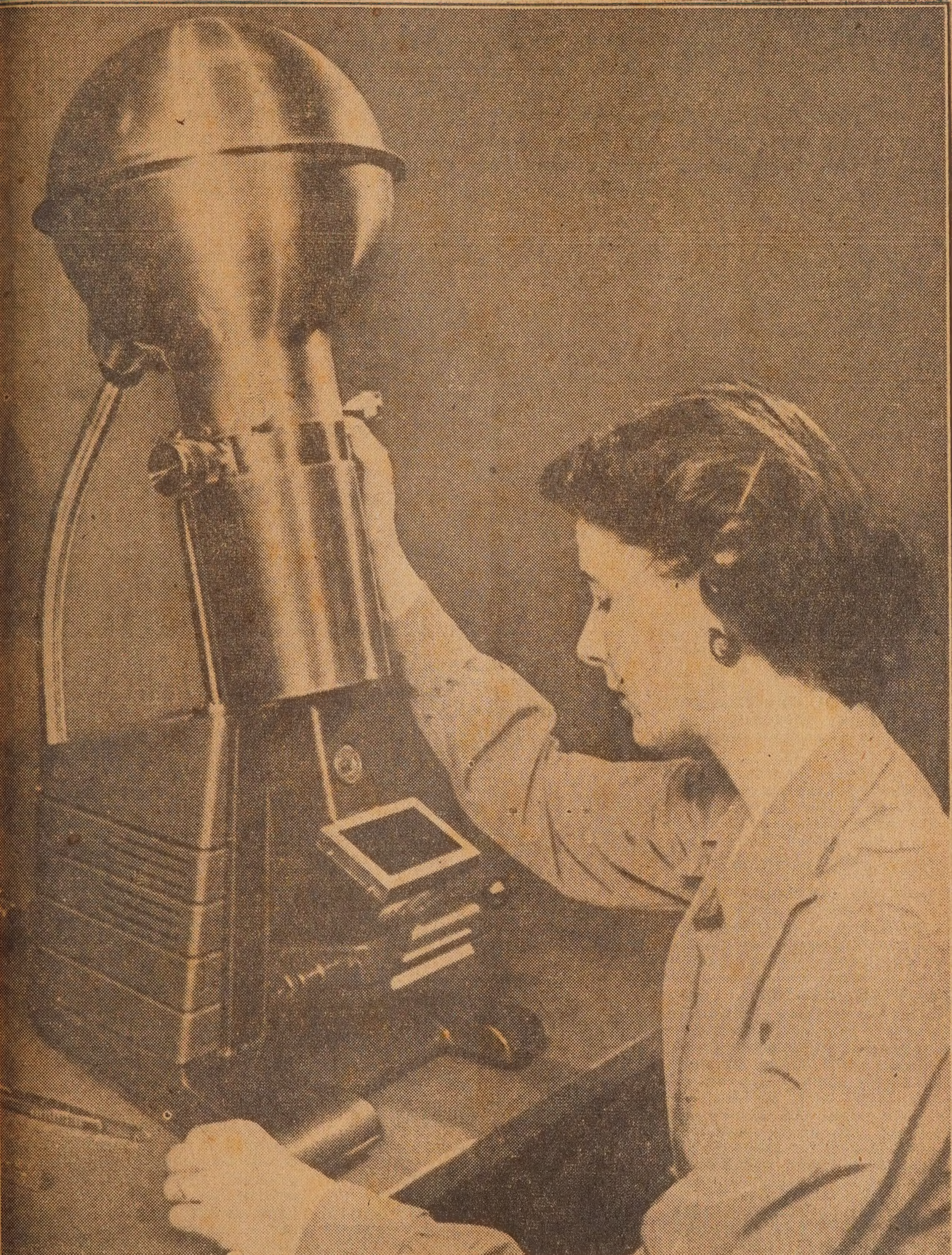
MINIATURE ELECTRON MICROSCOPE



A far cry from the impressively large first models of the electron microscope, yet capable of much greater magnification than normal types, is this compact table model just announced. It has been designed especially for hospitals, colleges etc, where simplicity and low cost are important. (Further details page 13).

TELEVISION TENDERS CALLED

From a practical viewpoint the first step in providing Australia with a television station to be erected in Sydney has been taken in the issuing of tender specifications covering the equipment to be supplied. These specifications automatically include all the required information concerning standards, and as such may be considered as being a blueprint for the proposed service. Very little alteration is anticipated by the time the station is in operation, except possibly for a few details.

by The Editor

ONE'S first reaction in reading through the specifications is of the huge amount of material concerned, its complexity, and the wide field it covers.

For instance, not only has the transmitter been split up into a large number of individual units—audio, video, aerials, cameras, &c.—but there is also a list of studio requirements which must be met, and ancilliary equipment, such as mobile vans, all of which add up to the total of a complete television installation.

As the tender is for an experimental station, it is unlikely that all this material will be required immediately, particularly those items essential to the supply of an everyday service. It is pretty obvious, of course, that this station will eventually emerge from an experimental role into that of a permanent transmitter, but it is also the intention to treat it as the guinea pig for the solution of the many problems, and the acquisition of experience, both required for use elsewhere as the service grows throughout the country.

It is for these reasons that the tender sheets are so comprehensive, indicative of a planned and workmanlike effort on the part of the engineers responsible.

GENERAL REQUIREMENTS

Broadly speaking, the requirement is for a monochrome television station for Sydney, "incorporating up-to-date practices and facilities, and enabling high-quality programmes to be derived from film, studio, and outside broadcast sources."

The matter of color is not mentioned except as a possibility for the future, so it is reasonably certain that, unless great strides are made within a very short while, we will not see color here at least for some time after the service has commenced. To quote again from the schedule—"In the event of later introduction of color television, it may be necessary to alter the monochrome standards to be compatible with suitable color television standards," and this fact is to be considered when making a tender.

Just what this means is hard to tell, because it is extremely doubtful whether anyone can say at the present time just what are "suitable color television standards." I think it is fairly safe to assume, therefore, that, for the moment, the PMG is not worrying itself unduly about color.

In this respect, I think we should remember that this is primarily an experimental transmitter, and its future as a permanent installation will undoubtedly depend on the development of color overseas, as will, of course, depend the future of other transmitters which will follow it elsewhere in the Commonwealth.

MANY SECTIONS

The method by which the various items of equipment have been broken up into sections indicates that more than one firm will participate in the supply. Cameras, valves and aerial systems, to mention only a few, may well be supplied from widely varying sources.

Some of these will probably be outside Australia, both in the interests of economy and because of their specialised nature. It is sincerely to be hoped, however, that as much of the material as possible will come from Australian factories. It is too much to hope that our resources could cope with the supply of this and duplicate equipment without extensive additions in the way of space, tools and skilled labor. But, wherever a satisfactory job can be done here, it should be done. We should not rely on outside help more than is absolutely necessary if we are to seize fully the opportunity to consolidate our own television industry, and the many other things which go with it, and build round it.

The frequency bands selected for the service are set down with the schedule, and the initial channels will be within the band of approximately 180-204 megacycles. This means that our initial receivers will need to tune over this band if the first set of transmitters are to be received. There are three channels within this band, and, at a later
stage, two more channels may
added, extending the band from 17
216 megacycles.

There are no great difficulties
making good receivers or transmi
ters within this range, and speci
equipment such as radar has ope
ated there for many years. Circui
and valves now available will
work there quite well, although t
techniques employed may be new
many radiomen used only to t
lower frequencies.

The schedule states also that wh
these five channels have been tak
up, others may be added, extendi
lower in frequency to 54 megacycl
with a total of nine. It is unlike
however, that these extra chann
will be required for a very lo
time. In my opinion, future develo
ments in television, if overseas e
perience means anything, are mu
more likely to take place on freque
cies higher than those for the initi
service rather than lower.

USA INFLUENCE

In comparing the standards
general with those used elsewhe
it is obvious that the PMG has be
influenced greatly by American e
perience.

One example of this is the pr
vision for sound and video freque
cies quite close together, so that t
receiver IF channel may be ma
wide enough to accomodate the
both. The picture channel uses A
but the sound will use FM. D
velopment overseas of new tec
niques in demodulators may s
further simplify (if simplificati
can be truly be applied!) the pro
lem of receiver design.

On the video channel, negati
modulation will be used, that is,
decrease in initial light intens
causes an increase in radiated pow
This is also the American meth
as against the British standard.

Aerials will be horizonta
polarised as against vertical, wh
means that the aerials will use e
ments suspended horizontally. It
generally agreed that this type
polarisation is less susceptible
noise pickup than is vertical, a
has a number of advantages wh
directional types are used.

The number of frames per seco
which means, of course, the numb
of full pictures which are shown
the screen in each second, is to
50, as against 60 in America. Wh

his allows a narrower bandwidth o be used in the receiving equipment, and to some extent saves on omplexity and cost, it is not altoether clear why 60 frames should ot have been used, particularly as he schedule points out that, in the vent of color television, the standard vill probably be raised to 60 rames.

Where the synchronisation or keeping in step" of the transmitter ictures with the receiver is accomlished by making use of the 50 ycle mains frequency, there is a ood argument for using 50 frames. xperience has shown, however, hat the problem of keeping the mains upply over the whole service area xactly in phase is too great, and herefore the mains are not employed or this purpose.

LLUMINATION

The use of 60 frames allows a nuch higher degree of flicker-free creen illumination, and it would have eemed logical for this figure to have een adopted as the standard right rom the beginning. Maybe it is nother pointer to the fact that color elevision is not visualised for some ime to come.

Subject to the acquiescence of the Department of Civil Aviation, it is roposed to erect an aerial system f up to 500ft, which, when erected s it will be on high ground, should ive the transmitter quite an extenive range. As the radiated power s to be five kilowatts peak, this vill bring a satisfactory service to esidents of the city and surroundng areas well beyond the metropolis. t is doubtful whether higher power vould be justified, at least until urther experience has been gained. t is much more important to select he best possible spot for the adiator.

This mast will also carry aerials or various radio-links for programme pickup and relay, plus acilities for an extra radiating sysem, presumably to accomodate a econd channel should this be required.

M FOR SOUND

The use of FM for the sound channel is an interesting decision, and nay have been inevitable if other characteristics of the system are to e preserved. If both sound and video used AM, for instance, it may vell be impossible to pass them both hrough the same IF channel in the eceiver, and separate them in the emodulator stage, without one inerfering with the other. At any ate, it seems likely, as has been aid, that many of the initial difficulties associated with FM receivers re gradually being ironed out, thus emoving some of the objections to t, particularly from a manufacturng angle.

At the same time, the servicing opulation in particular should, I hink, take special note of this use f FM. It means that they will have et another unfamiliar technique to naster in addition to that of television itself. We have a reasonble breathing space ahead of us

(Continued on Page 7)

TELEVISION STANDARDS IN BRIEF

TELEVISION CHANNELS

The width of the standard television channel shall be 7.5 megacycles per second.

The channels initially used for television will be:

181.5-189 megacycles per second
189-196.5 megacycles per second
196.5-204 megacycles per second

At a later date, the following channels will be available:

174-181.5 megacycles per second
208.5-216 megacycles per second

The unmodulated sound carrier shall be 0.25 megacycles per second below the upper frequency limit of the channel and the picture carrier 1.25 megacycles per second above the lower limit, so that the carriers are spaced 6 megacycles per second apart.

AMPLITUDE CHARACTERISTIC

Vestigial sideband transmission shall be used, the maximum amplitude versus frequency characteristic of the radiated picture signal shall be as shown in Australian Broadcasting Control Board Drawing No. ZC-2-A.

SCANNING SPECIFICATIONS

The standard number of scanning lines per picture shall be 625, interlaced two to one. The radiated signal shall be monochrome.

The picture frequency of the radiated signal shall be 25 per second, and the field frequency shall be 50 per second nonsynchronous with the power mains supply, and held within a tolerance of plus-minus 0.002 per cent.

The standard aspect ratio of the transmitted television picture shall be 4 units horizontally to 3 units vertically.

During active scanning intervals, the scene shall be scanned from left to right horizontally, and from top to bottom vertically at uniform velocities.

PICTURE MODULATION

The carrier within a single television channel with both picture and synchronising signals shall be amplitude modulated, the synchronising and picture modulation occurring alternately on a time division basis in accordance with Australian Broadcasting Control Board Drawing No. ZC-2-C. The wave form shown in the Drawing No. ZC-1-C represents the carrier envelope at the transmitter output before the lower side band is attenuated, and not necessarily the video waveform at the transmitter input.

Negative modulation shall be employed, that is, a decrease in initial light intensity shall cause an increase in radiated power.

BRIGHTNESS

The black level shall be represented by a definite carrier level independent of light and shade in the picture.

The transmitter output shall vary in substantially inverse logarithmic relationship to the brightness of the subject. No tolerances are specified at this time.

The transmitter shall transmit the black level at 75 per cent of the peak carrier amplitude with a tolerance of 2.5 per cent of the peak carrier amplitude. The black level shall be as nearly equal to the pedestal level as the state of the art will permit.

LINE FREQUENCY

The line frequency shall be maintained at 15,625 cycles per second plus-minus 0.002 per cent.

WHITE LEVEL

In the modulation of the picture transmitter, the radio frequency signal amplitude for the maximum white shall not exceed 15 per cent, nor be less than 10 per cent of the maximum carrier amplitude.

SOUND SIGNAL

Frequency modulation shall be used for the television sound transmission.

The transmitter shall be capable of operating with modulation frequencies between 30 cycles per second and 15,000 cycles per second.

Pre-emphasis shall be employed in the sound transmitter in accordance with the impedance-frequency characteristic of a series of inductance resistance network, having a time constant of 75 micro-seconds.

In the sound transmitter, the deviation for full modulation shall be plus-minus 25 kilocycles per second.

POLARISATION

The radiated signals from both sound and picture transmitters shall be horizontally polarised.

The ratio of peak power output of the picture transmitter and mean power output of the sound transmitter shall be two to one.

The overall frequency response of the picture transmitter shall be within the limits of the demodulated output specified in Drawing No. ZC-3-A from the vestigial sideband filter.

The frequency response of the sound system from microphone output to sound transmitter output shall be within the limits set out in Drawing ZC-4-A.

The picture transmitter shall be suitable for use with inter-carrier type of receivers. The phase modulation of the transmitted picture shall be such as to cause negligible noise in an inter-carrier receiver for modulating frequencies in the range of 30 to 15,000 cycles per second.

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Price: £23/15/- plus tax.

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2

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Other features: Meter scale, 4"; all measurements from two terminals only; bakelite housing; test leads supplied. *Accuracy, reliability, low cost.*

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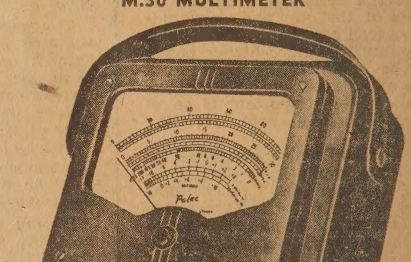
M.30 MULTIMETER



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P.40.FP

SUPER CONDUCTIVITY AND ISOTOPES

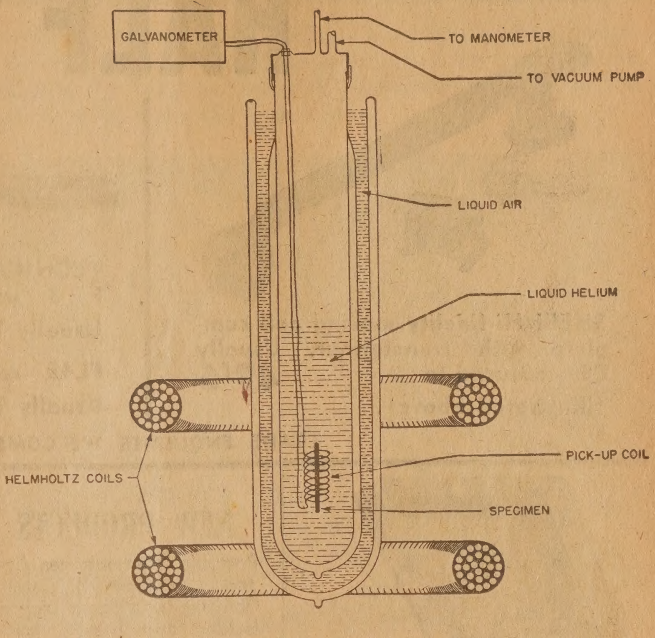
Recent low-temperature experiments conducted by Dr. Emanuel Maxwell of the National Bureau of Standards have resulted in the discovery of a new and wholly unexpected relationship between superconductivity — the loss of electrical resistance at very low temperatures — and the constitution of the atomic nucleus.

IT was found that the pure mercury isotope 198 becomes superconducting at a temperature about 0.02 degree K higher than does natural mercury, which is a mixture of five different isotopes having an average atomic weight 200.6.

Although a great deal of research has been done in the last few years on the remarkable properties of matter at low temperatures, there is as yet no adequate theoretical explanation of superconductivity. To provide a basis for a better understanding of the properties of matter, the National Bureau of Standards is now making studies seeking a more complete explanation of this and other low-temperature phenomena. In the course of these studies, it was suggested that the transition temperatures at which different isotopes of the same element become superconducting be investigated to determine whether the mass of the atomic nucleus has any effect on this temperature.

Until now it has been generally supposed that super-conductivity is concerned exclusively with the properties of the electronic configuration outside the nucleus. However, the results obtained at the Bureau, in combination with an independent and almost simultaneous discovery of the same phenomenon in other mercury isotopes at Rutgers University, establish the validity of the nuclear effect beyond question. The two researches are complementary and when taken together provide a conclusive demonstration of the effect.

In the Bureau's experiment, the superconductor, a long thin needle of mercury enclosed within a sealed capillary tube, was placed inside a pick-up coil consisting of many turns of fine wire. The superconductor and pick-up coil were immersed in liquid helium within a Dewar flask surrounded by liquid air, and the pick-up coil was connected to a ballistic galvanometer.



This apparatus was used to investigate the isotope effect in superconductivity.

The critical field for a given temperature was then obtained by slowly increasing the current in a set of Helmholtz coils surrounding the liquid air bath. When the critical field was reached, the specimen suddenly lost its superconductivity and was penetrated by the magnetic field of the Helmholtz coils.

The resulting change in flux linkages in the pick-up coil induced a voltage that caused a deflection of the galvanometer.

By varying the pressure within the Dewar of liquid helium, the temperature of the specimen was controlled in the range between 1.5 deg. and 4.2 deg. K with relative ease.

The experiment was repeated at a number of different temperatures, and the critical field was determined for each temperature. The critical field was then plotted against temperature, and the resulting curve was used to determine the transition temperature of the material under study. In this way it was found that pure Hg198 has a zero-field transition temperature of 4.177 deg. K as compared with 4.156 deg. K for natural mercury.

To make sure that the effect observed was due to the difference in mass and not to chemical impurities present, the mercury samples were carefully distilled to rid them of impurities. As the mercury had originally been prepared by bombarding gold with neutrons, there was some possibility of residual gold contamination. However, it was not possible to make a spectrochemical analysis of the Hg^{198}; instead 0.1 per cent of gold was added to some natural mercury, and the critical field curve of this material was determined. Within experimental error there was no difference between the curve for pure natural mercury and that for mercury with gold added. It was therefore concluded that gold contamination, if present in the Hg^{198}, was unimportant.

TENDERS CALLED FOR TELEVISION

Continued from Page 5

before radio receivers come due for servicing under a television service, and it would be a most unwise technician who failed to make use of it to learn as much as he possibly can about both.

This, I think, underlines the wisdom of experimental services in both spheres, for it is even more important to keep receivers operating efficiently that it is to make their initial sale. While it might be possible for manufacturers to make some preliminary arrangements for servicing their own receivers, the day must come when they will not be able to cater for it. Viewed from any angle, tomorrow's radio technician will no longer be able to keep up with the times with a screwdriver and a multimeter. To do them justice, a great number have even today, progressed well beyond this stage.

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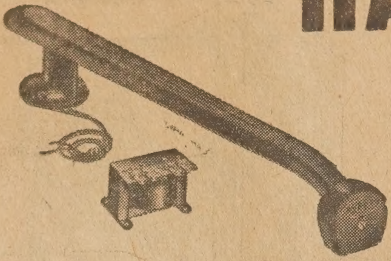

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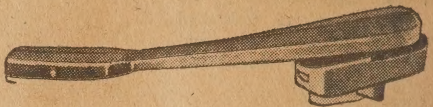

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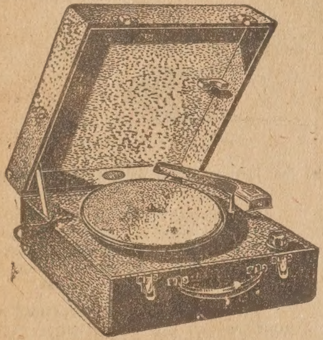

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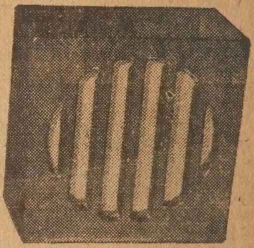

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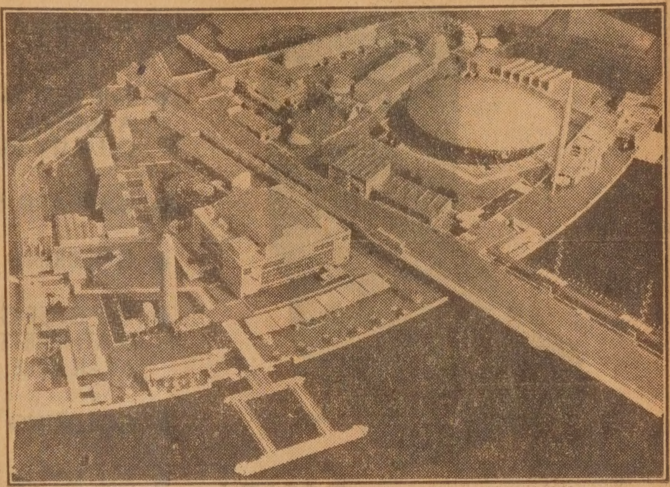
NEW HALL PUTS SOUND FIRST

Men have made buildings for countless reasons but never until now has a building been designed around SOUND. Yet this is the amazing architectural conception which is now rising in the heart of London, destined to become the Royal Festival Hall, permanent memorial to the Festival of Britain 1951 and a new music centre.

By S. G. Coller

THE great hall which, besides acting as a concert hall, has been esigned as a centre for all the arts. is the work of a team of 15 archi- ects on the staff of the London ounty Council, led by Mr. R. H. latthew and aided by scientists, athematicians, acoustics experts nd musicians, including Sir Malcolm argent, the well-known United ingdom conductor.

Unlike other buildings, the Royal estival Hall was designed from the nside out! The reason for this was hat the first priority was to achieve erfect musical acoustics in the ain concert hall—a hall with a aximum audience capacity of 3537 nd a platform accommodating an rchestra of over 100 and a choir of 50. After consultation with musi- ans and scientists, the shape hosen was that of an egg with two at sides, the exact size and shape eing determined by mathematicians.



A model of the site for the centre-piece of the 1951 Festival of Britain on the south bank of the Thames. The hall is near the centre of the picture. The large circular building on the right will be the dome of discovery.

GRECIAN STYLE

Inside this "egg," the auditorium raked in Greek fashion, and the latform which faces it is also tepped up. At the point where the wo meet, the Greeks used to put an rnamental pool, the water acting as reflector for the higher frequency otes which tend otherwise to be bsorbed before they reach the arthest seats.

Instead of water, the Royal Fes- val Hall will have an immense slab f slate to do this vital job. Above ne platform, a corrugated orchestra eflector will be suspended from the eiling for a similar purpose, the eiling itself being corrugated to rovide the optimum diffusion of ound.

OLISHED WALLS

But the care of the designers has ot ended there. The platform and de walls will be highly polished to ive maximum sound reflection, and o carpet will be used, to avoid ab- orption. Percussion, instruments, ke drums, will have their own con- ete platform to reduce resonance.

The lower walls of the hall will e faced with interlocking wood anels which, though highly decor- tive, have been specially designed absorb the lower frequency notes. imilarly, leather panels at the back f the hall are there, not for beauty, ut to absorb echo.

But the last and finest adaptation ust be left to musicians themselves. Vhen it is built, this amazing hall ill, therefore, be "tuned." The pper part of the walls is of removable plywood panels, which will be taken out, bored and fretted until an almost exact balance of sound has been obtained.

For three months during the Festival of Britain next year, orchestras will play and musicians listen from all parts of the hall until this is done. Then, to obtain final perfection, hundreds of plugs in the ceiling will be taken out here and there and wooden baffles in the shape of milk bottles substituted. Then, at last, reproduction should be perfect from every seat or box, whether the hall be full or not—for the seating has been so designed that the sound reproduction qualities of the hall remain unaffected if it is empty.

All this work, however, would be useless if London's hum and bustle could penetrate the walls of the great hall. Within a few hundred yards is the sprawling railway terminus of Waterloo, and the Thames itself carries its whistling tugs and jostling barges slowly past the facade of the hall. To keep out all this noise, the egg-shaped hall itself has cavity walls formed of two skins of concrete with an air space between.

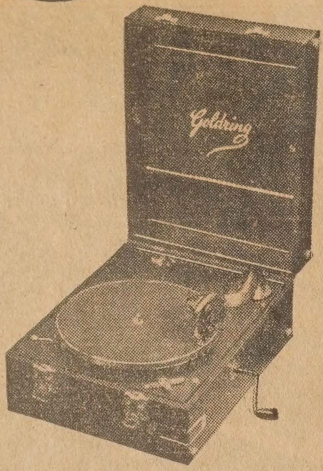
Nothing except the specially-designed double doors into the hall, surrounded by soundproof baffles, has been allowed to penetrate this shell. Not even heating and ventilating pipes pass through it, the air being conditioned by the downward discharge system, being extracted beneath the auditorium floors and balcony.

ADDITIONAL PORTIONS

The other parts of the building are scarcely less remarkable than the main hall. They will include the largest foyer in London; a restaurant on two floors for 700 people, commanding views of Britain's capital through a glass wall; a small theatre seating 750 people, designed for chamber music and dramatic performances; a suite of specially lighted picture and exhibition galleries; promenades, and passenger lifts carrying 2000 people an hour; a library, instrument store, full-size orchestra practice room, many smaller practice rooms, and so on. Outside, where part of the River Thames has been reclaimed and a new embankment built, visitors will approach along a new river promenade with fine gardens.

Goldring

Portable Gramophone



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TWENTY YEARS FROM NOW

Twenty years from now the average man and woman will be perhaps a little taller and weigh more. That prediction requires no great skill, for we can see the improved physique due to better diet and housing conditions already.

(Concluded from last month)

THE average man will perhaps have an expectation of life that two or three years greater. Many erm diseases are already on the way being completely conquered. New hemicals and treatments promise to emove yet more common causes of remature death.

All this does not mean we shall ave more tall men and women and ore centenarians. It simply implies at the "normal" height will be little increased and that far more en and women will live to the ree score years and ten which is e traditional span of life.

We now have in Britain an im- rtant research school into the uses of ageing. Russian scientists ave been performing dramatic ex- eriments in prolonging the span of fe and say that man's normal age death should be nearer 150 years an 70. But I do not think this work n bear much practical fruit in 20 ears.

In any case, in Britain scientists e looking for means of postponing nility rather than death, of enabl- g people to enjoy a healthy and gorous old age rather than avoid ying.

OCIAL CHANGES

These physical changes will have eat social, economic and political sults. The social changes are ob- ous. Many of us can remember e time when a woman was ex- cted to occupy a chair by the fire d do nothing active immediately e became a grandmother. Today u can find grandmothers in the ctories—and enjoying it.

The idea that a man should retire om work as soon as he can afford do so will disappear. Already we n see that the prewar encourage- ent towards early retirement has ven way to a campaign to keep ople working even when they be- me entitled to an old age pension.

The longer average span of life ill raise acute economic and politi- l difficulties. The problem was put a nutshell by a witty friend who d just read of some new drug that red a high mortality disease. nother half-dozen drugs like peni- lin," he commented, "and we shall t a shilling on the income tax for d age pensions."

What he was pointing out is the ct that old age pensions have to paid for and they can only be id for by the younger, working pulation. If in the future we eatly increase the proportion of d people—and that is almost certain we shall either have to increase the pension age, reduce the amount of the pensions or make our young people work a great deal harder.

Neither of the first two steps would be politically popular. To pay for penicillin, so to speak, young people will have to produce more. Very probably we shall have to make much more scientific use of our man-power so that our older people are able to continue working.

This is an interesting example of the far-reaching social and economic effects of scientific discovery and a warning to politicians to look ahead before making promises.

PHYSICAL CHANGES

Permanent physical changes in the human body take place in centuries, and many thousands of years, rather than two decades. But 20 years hence changes now taking place may be much more obvious. Probably not one person in 10 will have normal eyesight, although the general adoption of "contact lenses" may make the spectacle wearer rare except among the over sixties.

Our sense of hearing will probably be further atrophied in an attempt to combat the harmful effects of noise. Millions of people will have had 30 years of listening to music on the wireless and will hardly be capable of hearing the full range of "real" music. Wireless completely cuts out the reproduction of sound frequencies above 5000 cycles and custom will have made the limited reproduced sound seem more "natural" than the "real" sound!

by Professor A. M. Low

One big change will be beneficial. The "reaction time" of the average man and woman will have been greatly speeded up and accidents with machinery reduced as a result. The present heavy toll of the road is partly due to our dealing with twentieth-century machines with eighteenth-century nervous systems.

The chief victims are the very young, who have not yet learned, and the very old, who cannot learn. In 20 years a very much larger percentage of the population will have been brought up in 60 mph conditions. They will be naturally as much more skilled in judging the speed and direction of machines as the average city dweller of today is compared with a native from the wilds.

WOMEN'S WORK

The biggest changes in the next 20 years will be those affecting women. In fact many of the changes are now taking place, but it will take years to make them apparent.

The real "winners" in the war have been women, and everyone seems to be busy making the world a more comfortable place for women to live in. When we talk about "labor-saving devices" we always refer to devices that save women labor. All the ingenuity of inventors and output of manufacturers is devoted to reducing "women's work."

Men have got left behind in this struggle to be free from work—we get plenty of vacuum cleaners, washing machines and automatic irons, but no one troubles to market a cheap automatic shoe-cleaning machine because the shoe cleaning is considered man's work!

With the Government providing meals for her children at school, her husband eating at restaurants, and the local authorities providing "home helps," the housewife of 20 years hence looks like carrying the title in a purely honorary capacity. The fact that women will no longer be content to be cheap domestic drudges will be very plain. The best houses of 20 years hence will require about one hour's work a day, and canned, quick frozen and other labor-saving foods will enable the housewife to have a 20-hour working week.

DIVORCE

Many people suggest that the increasing relief of parents of their "responsibilities" to their children will result in the break up of marriage and the family. On the contrary, I suggest that 20 years hence the family may be a much firmer unit as a result.

Instead of harassed parents being so busy with the mere business of feeding and clothing their children that they have no time to understand them, they will have the means and time, if they wish, to become their real companions.

The knitting together of the family will not be simply a legal one, with the parents tolerated as old bores simply because they are necessary to provide food and shelter. It will be based on real understanding and sharing of interests. Freedom from

(Continued on Page 13)

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A COMPACT ELECTRON MICROSCOPE

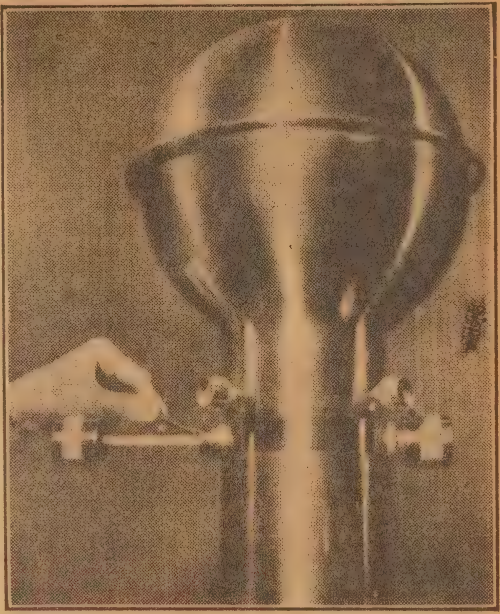
The electron microscope, developed some time ago, is now a standard instrument providing magnific-ation much greater than obtainable from previous types. The original design was both bulky and costly, which makes the announcement of this smaller version of great interest and value.

A NEW, advanced model of the electron microscope, much lower in cost, less complex and only 30 nches high, has been developed by RCA and will e placed on the market later this year.

Features of the new microscope—its reduction n bulk, complexity and cost—are expected to appeal articularly to many colleges, hospitals and industrial aboratories.

Of special significance is the fact that the lower nd of the magnification range of the new instrument verlaps that of the conventional light or optical microscope, permitting the student to progress by ages from the known to the un-nown. He may thus relate the articles and structural details he bserves to those made familiar to im by the optical microscope, be-ore advancing to higher magnifi-ations which disclose a vast amount new detail that he might other-ise be unable to identify.

Equally important is the simplicity operation achieved in the new esign, which makes the instrument fe for operation in the hands of high school student or unskilled boratory personnel. With no more an an hour of instruction, an erator generally familiar with the tical microscope should be able insert specimens and produce well-cused pictures.



Specimens to be observed in the table electron microscope (see page three) are inserted into the instrument through the small rod shown here.

ME SAVING

A unique advantage in time-sav-g and convenience is afforded by engineering advance which for e first time permits insertion of ecimens into the evacuated column, nd their removal, without breaking e vacuum. In addition, photo-aphic plates may be changed with-t admitting more than a small mount of air to the column. As result, pumping time between ates is reduced to only 90 seconds.

Marked simplicity is achieved ithout sacrifice of high-quality per-rmance by means of a combination design factors, including an en-rely new electron optical system mploying permanent magnet lenses stead of the conventional electro-agnetic or electrostatic lenses. hrough the use of permanent mag-ets, usual stability is permanently chieved and many controls and mponents are eliminated.

Incorporating "new approaches to e problem of energising magnetic nses, new means of introducing ecimens and photographic plates to the vacuum enclosure, and a ew means of alignment of optical mponents" the instrument was developed specifically to meet "the microscope problems now clearly defined by experience, by simplifying constructional design to essentials, and by utilising new materials in an intregrated design."

TWENTY YEARS FROM NOW

(Continued from Page 11)

drudgery offers women great opportunities and will, in coure of time, profoundly affect their psychology and social relations.

So with marriage. If you project the "graph" of rising divorces for the past few years, it could be forecast that in 20 years there will be more divorces than marriages! But this will not be the case. The present urge for divorce is not due to divorce being made "easier," but to abnormal war conditions accompanied by a social morality that in some ways is 50 years out of date. In 20 years time divorce may be even "easier" in the sense that if both sides desire it, they will not be debarred from it by lack of money, or the need to go through with the pantomime of cruelty or infidelity that the law demands.

But it is probable that marriage will be a very great deal more difficult. We are seeing the absurdity of making unhappy people wait years for a divorce. We are beginning to see the absurdity of letting anyone who has a few shillings in their pocket get married in five minutes If couples had to go to court to prove why they should be married, as they now have to prove why they should be divorced—with the King's Proctor ready to intervene if he feels the marriage is doomed to failure—we should have far fewer divorces.

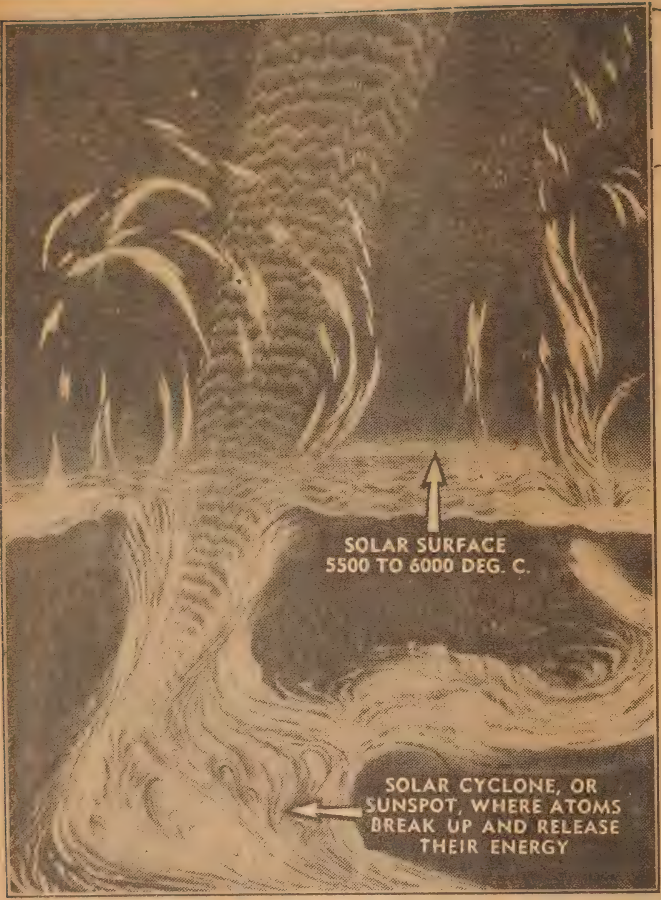
It is an old saying that "human nature doesn't change." That is absurd, as anyone who tries to behave like a caveman or even Henry VIII today quickly discovers. Fundamentally, we may still be ruled by the same primitive appetites, but the whole business of controlling them which we call civilisation changes quite rapidly.

In 20 years I believe that men and women will be much more straightforward in their social intercourse. The need for demonstrating their "freedom" which led to absurdities and excesses 20 years ago will have gone. Fear which has ruled human beings for centuries will be much less. We are no longer terrified, like savages, by fear of lightning, famine and disease, but we still have some fear of modern but no less superstitious bogies, like unemployment and war.

In 20 years' time the effect of education should be apparent, and the average man will realise then that unemployment, war and the other ills of civilisation are not bogies to be propitiated by certain rites and the uttering of magic words, but diseases to be scientifically studied.

SUN SPOTS AND DAILY LIF

Despite our distance from the sun, we know a great deal about what goes on inside it, and the effect of its surface disturbances, or sun spots, on the earth. These may yet prove to be more profound than we have so far imagined.


SOLAR SURFACE
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SOLAR CYCLONE, OR SUNSPOT, WHERE ATOMS BREAK UP AND RELEASE THEIR ENERGY

Emission of radio waves from the sun coincides with intense sun spot activity. They can be identified quite clearly on radio receivers using directional aerials and frequently cause serious interference to radio services. Dependent on reflections from the ionosphere.

DO sunspots affect human behavior? Have they any influence on our weather conditions? Are economic conditions controlled by them? Are they responsible for periodic disease epidemics?

In any age but the present such questions would have been laughed off as being the product of an unsound mind. Yet, today science has good reason to believe that sunspots have a more profound effect on our way of life than has been hitherto thought.

Some notable scientific personalities believe that the anwser to the above questions is in the affirmative and have gone to tremendous labors to prove their contentions. But let us begin at the beginning.

We do not propose to go into any lengthy explanation of the causes of sunspots. Rather are we more concerned with their effects.

ATOM PROCESS

Atomic energy has been in the headlines for many months now. Man has at last learnt the secret of releasing the energy of the atom but, as yet, has not learn the secret of its control.

Nature, however, has been using controlled atomic energy since the universe began and it is this energy which is the source of heat and lig which emanates from the sun.

The process which goes on i the sun wherein the atoms are tran muted is, while somewhat compl cated, an interesting study.

For many, many years scientif brains have been trying to sol the riddle of the origin of the sun seemingly inexhaustible energy b it was not until 1939 that Profess Hans Bethe, of Cornell Universit USA, worked out a theory whic has been accepted as fundamental sound.

It has been a favored theory f a long time that it may be possib to combine hydrogen atoms in suc a way that one helium atom mig result, with a loss of weight in t combination of about one per cen It is this loss in weight whic would represent the amount energy available for radiation light and heat.

IMPORTANCE TO LIFE

The sun is very rich in hydroge and carbon. It has also been prove that helium is a constituent of t sun. This being so, Professor Bet reasoned as follows (and if y can't understand this just conso yourself with the thought that is considered to be about true an way):—

An atom of carbon bobs alo its merry way and comes smac bang into an atom of hydroge Like Freddie Dawson or Dave San it gets the better of its oppone the hydrogen atom, and penetrat into the nucleus where it hits proton.

This proton is given the KO a is absorbed. But the carbon suffe from this encounter and there com into a being a special form of nit gen, lighter in weight than ordina nitrogen, and radioactive.

This nitrogen soon disintegrat into a form of carbon which heavier than the original carb Again a stray proton strikes t atom and it becomes ordinary nitr gen.

This, in turn, is hit by anoth

ydrogen nucleus which produces adioactive oxygen and later this urns into a form of nitrogen which stable.

Along comes another proton and angs this nitrogen into two separate toms of different kinds, one of hich is helium. Thus hydrogen has een changed into helium and we ave left the original carbon which arted us off.

Now this involved process cannot e carried out without some losses nd it has been calculated that for very 400 grams of hydrogen which changed in this way into helium here is a loss of weight of three rams of matter which is radiated s energy, such as the light and eat of the sun. Incidentally, this ppears to be the process by which he madmen among scientists hope o make the hydrogen-bomb.

IFE OF SUN

If they succeed then there may ot be any life left on the earth when the sun peters out in 35 billion ears time. This is the estimated fe of the sun based on a loss of weight of four millions of tons of matter radiated as light and heat very second.

Yes, the sun is rather a large affair nd still weighs (so they say) 2 followed by twenty-seven noughts of ons. I refuse to name that figure n trillions or quintillions or whatever it is. A reader took me to ask once before over a somewhat imilar figure. It all seems to rest n whether a billion has nine or welve noughts. Please yourself. Who cares anyway?

While the output from the sun s fairly constant there are times when something happens inside it. Explosions take place which result n violent eruptions. These are real tomic explosions and their effects re noticed here at a distance of 93 millions of miles away.

When these explosions take place, he sun appears dotted with groups of dark areas. These are the sunspots we hear so much about.

These spots radiate vast amounts of energy which, striking our upper atmosphere, ionise or electrify the gases therein, causing them to actually become luminous like a neon sign and producing the Aurora Borealis in the Northern Hemisphere and he Aurora Australis in the Southern Hemisphere. There is interference in radio communication all over he world and telephone systems get you more wrong numbers than in normal periods, and that's saying something.

RADIO INTERFERENCE

Harking back to our questions at he beginning of this article, it is not difficult to see that, as the maintenance of life on the earth rests entirely on the energy from the sun, here may be something in the arguments put up by our friends. Let us look at this in some detail.

Dr. Harlan Stetson, of the Massachusetts Institute of Technology, puts he matter very concisely in these words:

"We may look upon all life on the earth as an aggregate of conglomerations of a curious substance called protoplasm. It (lift) exists only because of the presence of moisture, water, oxygen and other necessary chemicals. It continues to survive only because of the amount and quality of the light and heat radiated from the sun, and only so long as the temperature is maintained through a relatively small range of variation. Life is subject to gravitational and electrical forces concerning much of our environment. We know that each cell of this protoplasm is composed of molecules and atoms which in turn are bundles of electrical energy. Modern science has made us increasingly aware of the electrical nature of this protoplasm. What subtle effects, changes in our environmental fields may have on life in any form we do not know. Numerous experiments are making us more and more conscious of the subtleties of the electrical potentials adherent to every living cell."

There we have the inference nicely put that being bundles of atoms having an electrical nature, we may be subject to electrical changes in our environment.

When sunspots occur there is a vast increase in the ultra-violet radiation from the sun and enormous electrical disturbances are produced throughout the earth's atmosphere.

ELEVEN YEAR CYCLE

Sunspots occur with a regularity about every eleven years. This is a basic fact which must be borne in mind when studying the collection of facts relating to the effects of these spots on our daily lives.

The weather is always of interest. It is well known that man is interested in the weather, not so much as to whether he will be able to get to work tomorrow but more as to whether he will have a fine weekend for the cricket. A weather man told me that most of the complaints about inaccurate forecasting relate, not to wrong forecasts during the week, but to rainy weekends when the forecast was for fine weather.

by Calvin Walters

Professor A. E. Douglass, of the University of Arizona, made a lifetime study of tree growths.

We all know that the trunk of a tree is made up of a regular series of rings, each of which represents one year's growth of the tree.

Professor Douglass noted that during periods which were favorable to the growth of the tree the space between two rings was wide. During unfavorable periods of growth, such as droughts and other conditions, the space was narrow.

Douglass examined thousands upon thousands of trees and even got hold of timber from tombs and other structures built thousands of years ago. He delved into ruins of ancient cities and even studied archaeology so that he could find clues to the whereabouts of likely resting-places for ancient timber.

These laborious investigations brought to light a most remarkable fact. The tree trunks were infallible records of weather conditions existing ages before man ever thought of weather forecasting.

TREE LIFE

More remarkable still, Douglass found that the variations in the tree rings corresponded almost identically with the eleven-year variations of sunspot activity. It would appear, therefore, that at least long period changes in weather or climate are related to the sunspot cycle, although considerable argument still proceeds as to whether daily changes in weather have anything to do with sunspots.

Other workers, notably Dr. Abbot and Mr. H. H. Clayton, working along the lines of rainfall records, snowfall, temperature, atmospheric pressure, &c., have also compiled valuable data which tends to prove that sunspots and weather are related.

The evidence so far gathered as to the effects of sunspots on human behavior is at yet far from convincing. The main trouble, of course, is that man is prone to act in a most curious manner on any occasion whatsoever and for no apparent reason.

Experiments, however, on animals whose behavior is based mainly on natural instincts rather than on its capacity to reason, tend to show that there is a distinct relationship between behavior and radiations from the sun.

We do know that ultra-violet radiation has strong effects on the glandular system. This has been proved on monkeys which (or should it be who) have been exposed to these radiations. Considerable increase in fertility has been evoked by this method.

SEASONAL CHANGES

It is not to be denied that even human beings are sensitive to the changes of the seasons which, after all, are caused by the position of the sun relative to the earth. It is reasonable to suppose that variations of radiation and the electrical disturbances caused by sunspots also have far-reaching consequences.

It is well known that the production of vitamin D in the skin of humans, plants and animals is dependent on the amount of ultra-violet radiation available. A deficiency of this vitamin will produce rickets, and sunshine is the cure for it.

Dr. Abbot, referred to earlier, has shown that there is an approximate

(Continued on Page 104)

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Technical Review

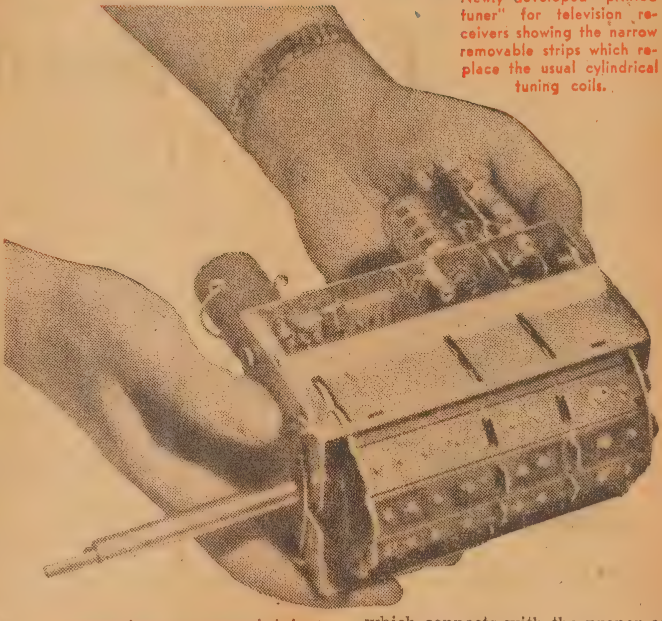
PRINTED TUNERS FOR TV

Development of a television tuning unit in which certain of the most important circuit elements are produced by a photo-etch "printing" process—in contrast to the usual wire-wound coils—has been announced.

THIS unit, which is heralded as a major accomplishment in home-receiver design, provides greatly improved performance of television receivers installed in fringe-areas, particularly when the instruments are operated from built-in antennas.

In design, the new unit is a cylindrical turret-type tuner. The turret assembly employs individual coil strips or segments, each containing the printed circuit for a separate television channel. The strips are easily removed for service or replacement. All the tuned circuits are printed with the exception of the oscillator coils for channels two to six.

Tuning is accomplished by rotating the turret by means of a conventional channel-selector switch which connects with the proper coils for each channel. Special features have been incorporated in the tuner to ensure durability and trouble-free service. These include stator contact springs of solid hardspring silver, and turret contact rivets of solid coin silver. The unit is capable of withstanding well over 40,000 complete revolutions of the turret.



Newly developed "printed tuner" for television receivers showing the narrow removable strips which replace the usual cylindrical tuning coils.

An operator lowers a copper-clad sheet of plastic, containing a photographic print of the circuits, into a vat.

PROVIDES UNIFORM GAIN

The new printed circuit tuner provides high and substantially uniform gain on all channels under typical operating conditions. Other features include an excellent noise factor, high rejection of spurious responses, very low radiation and a temperature-compensated, stable oscillator circuit. These characteristics make the new printed-circuit tuner especially suited to receivers using indoor antennas.

It is also the first to use a type of 6CB6 tubes as the RF amplifier. Characteristics of this tube include high gain, low noise, and low grid-plate capacitance.

Intensive research leading to the adaptation of printed circuits to television tuners was undertaken shortly after the end of the war

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A NOVEL HIGH PERFORMANCE MICROPHONE

A new type of ribbon microphone, which is both compact and unobtrusive is described by H. F. Olson and J. Preston in a recent issue of "Audio Engineering." Featuring a damped pipe as the pickup source, it is equally effective as a band or a stand unit and has uniform performance on sound from all directions.

THE desirability of using a small microphone is self-evident for most applications and the RCA "Bantam" ribbon unit was developed about two years ago with this requirement in mind.

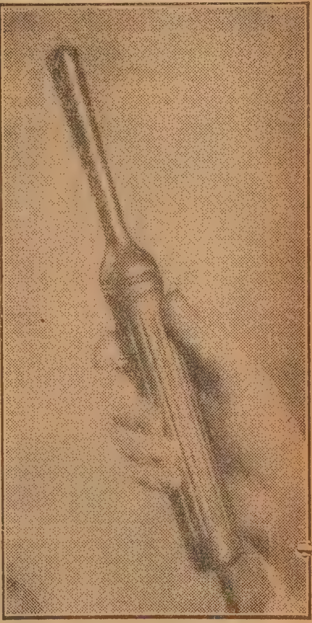
At the same time, consideration was given to other possible design approaches which ultimately led to the type here described.

Practice has shown that it is desirable for a microphone to have characteristics such that it can be used with any required length of cable in a studio without the provision for a built-in head amplifier. The additional leads required by such an amplifier necessarily increase the bulk of the cable or its likelihood of fracture.

Considerations along this line operate against crystal and condenser types, while the excellent fidelity characteristics of a ribbon unit completes a strong case in its favor.

After careful study, it was decided that a practicable ribbon assembly could be produced with an overall diameter of 1¼ inches, a ribbon length of 1 inch and a weight of one pound.

At the bass end, good response could be expected to about 40 c/s but diffraction effects around the structure would cause a loss of output above about 5000 c/s.



Figue 1. The small size and neat contours of the new microphone make it particularly suited for audience participation shows.

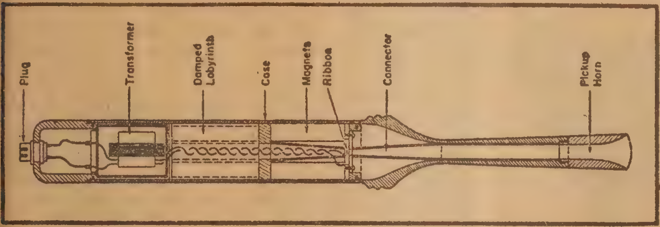


Figure 2 (above) gives a sectional view of the new microphone. Note the horn in front of the ribbon and the chamber behind it.

☆

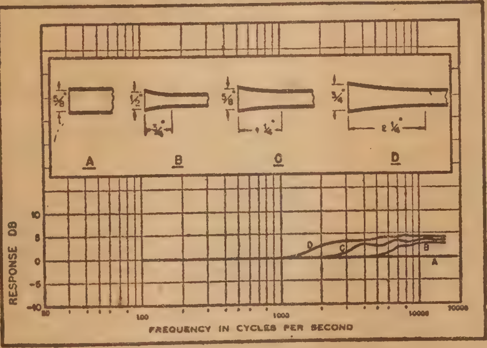


Figure 3. (right) illustrating the effect of horn dimensions on treble response.

To overcome this loss, a horn was added in front of the ribbon and so proportioned physically that its acoustic impedance matches the impedance of the ribbon. By selecting various dimensions for the horn, differing degrees of accentuation can be achieved which balances the slight variation in frequency response with angle of pickup.

The back of the ribbon is coupled to a damped, folded pipe of special characteristics.

Figure 2 shows the general assembly of the microphone. A pickup horn is coupled to the ribbon, the rear side of which feeds through a channel in the magnet structure into the rear damping chamber. Behind this chamber is the transformer, which steps up the effective quarter-ohm impedance of the ribbon to whatever working impedance is required for the outgoing cable.

The accompanying curve illustrates the effect on frequency response of different horn dimensions, also the ultimate frequency response to sounds arriving from different directions.

The finished microphone can be handled with ease and is particularly suited to audience participation shows. It can be slipped into a cradle on a special stand and used immediately for stage work.

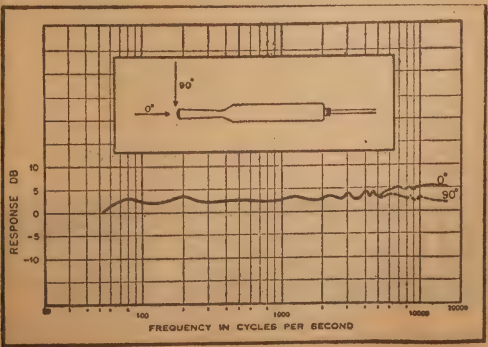


Figure 4. A frequency response curve of the complete microphone for two directions of sound source. The test was taken for an open-circuit or non-terminated condition. The excellent characteristics are evident. The low distortion characteristic of ribbon microphones is retained.

It's as easy as falling off a log

TO MAKE AND PLAY YOUR OWN RECORDS, EITHER STANDARD OR MICROGROOVE, WITH A BRS B-12-D RECORDER, AND PLAYBACK UNIT

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MICROGROOVE

Cuts costs of Discs by 75 per cent

Microgroove recordings, which are recorded and reproduced at 33-1/3rd rpm., have four times the capacity of ordinary standard groove discs. This makes it possible to record 8 three-minute numbers or one complete short work on each Microgroove recording, resulting in a 75% saving on discs.

Apart from longer playing time and saving in space and cost, Microgroove being cut at lower recording levels gives infinitely better reproduction. This is particularly noticeable in increased high frequency response with less distortion.

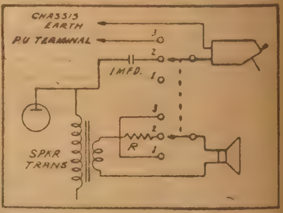
The extremely low noise level of BRS discs make them ideally suited for Microgroove use, the noise being still far below that of standard pressings. MICROGROOVE is the last word in sound recording technique.

The BRS R-12-D Unit—

1. Makes and plays its own records.
2. Plays ordinary commercial records.
3. Is easily fitted to any standard Radio, Radiogram or amplifier.
4. Provides 2-speed recordings — 33-1/3rd or 78 rpm.
5. So simple, even a child could operate it.
6. No adjustable parts necessitating service.
7. Maintains its characteristic high-quality for years.
8. Available for either standard groove or microgroove.

Easy to Instal:

The installation of the R-12-D can be easily and cheaply effected. All you need are a few low-cost components and this simple circuit diagram.



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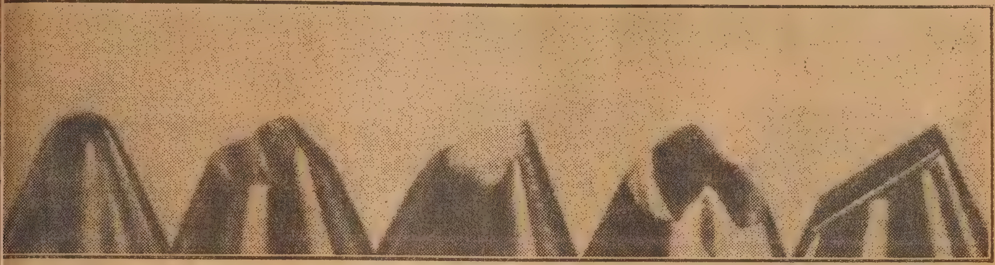
IAMOND STYLII BEST FOR WEAR



.5 mil stylii after 1000 plays on 10-inch Vinylite records with a 1¼ ounce pick-up. From left to right: diamond; sapphire, front view; sapphire, side view; osmium, front view; osmium, side view.

Although diamond stylii are by no means new, having been used in specialised pickups for many years, it seems likely that they may gradually be adopted for domestic pickups. In durability and hardness they have a very great advantage even over the popular sapphire.

IAMOND is a pure crystalline carbon occurring in volcanic k. While it is best known as a vel, there are colored or opaque es which are not suited for such , but which possess identical chanical and chemical properties. ere are also small chips and ints too small for jewels, but well ted for stylus tips in gramophone kups.

Diamond can only be cut or polish- by diamond, the usual practice ing to use metal tools impregnated th a mixture of diamond dust and ve oil. Extreme care and very gh speeds are necessary when lishing a diamond to avoid the nitations imposed by the inherent ystalline structure of the material.

Compared with all other materials, amond has an impressive advange in resistance to abrasion, hardss, lack of compressibility and, in ct, most of the characteristics reired of a stylus. Its one great sadvantage is the obvious one of ficulty to shape and polish.

APID WEAR

In ordinary stylii, wear is relative- rapid at first, slowly as the area contact increases. Contrary to pular opinion, soft materials do t necessarily mean less wear. Apart m the effect of steel on noniform groove shapes, there is a ndency for minute flakes from the lus to become embedded in the oove walls, increasing the abrasive ality of a disc with the number playings.

E. J. and M. V. Marcus have deribed in Audio Engineering a numr of tests made at both 33 and rpm, using vinylite discs and mestic type equipment.

The results of the standard groove st showed that after 1000 plays, approximately 50 hours playing ne, wear on both sapphire and mium tips was very severe. Conderable wear was noticed as early 100 plays. There was complete conformity to groove shape after 1000 plays. The diamond stylus did not show any wear after 1000 plays.

Shadowgraphic tracings were made after each 100 plays and showed the progression of wear on the sapphire and osmium tips. Photomicrographs were taken of the stylus tips after 1000 plays. Two views were photographed, one parallel to the groove position and the other perpendicular to the groove.

Superimposing the osmium shadowgraph tracing over the sapphire tracing, we found the same amount of wear for sapphire at 1000 plays as for osmium at 400, or a 10-4 ratio. Since the amount of material removed from the diamond was so slight as to escape notice at 500 times magnification, the ratio of resistance to wear could be written: Diamond infinity, sapphire 10, osmium 4.

The results of the microgroove test were rather surprising. We found that after only 15 plays or 5⅝ hours playing time, both the sapphire and osmium tips were very badly worn, and the test was stopped at that time. Again, the osmium wore out faster than the sapphire.

The diamond showed no sign of wear after 15 plays. The microgroove diamond was continued in use for a total of 100 plays, or 37 hours. A slight flat was noticed on the diamond at the end of 37 hours.

Showing different 1.0 mil stylii after fifteen plays on 12-inch Vinylite records with an 8-gram pick-up. Left, diamond; centre, sapphire; right, osmium.

Apparently, stylus wear is far more rapid on microgroove than on standard groove records. A rough estimate is about three times faster. The rate of wear of the 1.0-mil osmium and sapphire stylii caused by microgroove playing is so rapid as to make these materials unsuited for continuous use on microgroove records.

RECORD SURFACE

Other results of our stylus and record wear tests showed that wherever there was excessive stylus wear it was always accompanied by excessive record wear. The badly worn stylii are unable to track properly and have a tendency to chop off the high-frequency crests in the grooves.

It was observed that stylus pressure, pick-up arms and cartridges have a great effect on stylus and record wear. Considerable variation in rate of stylus wear was noticed in making wear tests on different types of equipment. For example, one professional arm caused 1.0 mil. stylii to wear out about five times faster than did other arms designed for amateur use.

Quality of response deteriorates gradually as stylus wear increases. This deterioration is noticed more readily on good quality audio equipment. On home-type equipment, with its narrower frequency range, stylus wear is usually not noticed audibly until it has become very bad.

SOLVE YOUR PROBLEMS WITH TAYLOR TEST EQUIPMENT

MODEL 47A-P

MUTUAL CONDUCTANCE VALVE AND MULTITESTER

MULTITESTER RANGES. 1000 ohms per volt A.C.-D.C.

D.C. Volts	D.C. Current	A.C. Volts	Resistance
0-120 m.V.	0-0.6 mA	0-3	0.5-22.5-1000 ohms.
0-3	0-6 mA	0-15	50-2250-100,000 ohms.
0-15	0-30 mA	0-150	x 500-22,500-1 megohm.
0-150	0-150 mA	0-300	x 5000-225,000-10 Megohms.
0-300	0-1.5 Amps	0-600	
0-600			x with external battery.

Fitted with large direct reading meter with illuminated dial and OVERLOAD PROTECTION. Tests over 2000 American English and Continental valves including latest types. Filament volts range from 1.1 volts to 117 volts. Filament continuity and element shorts shown directly on meter. Cathode leakage read in megohms. The instrument is housed in a solid oak carrying case and supplied with comprehensive instruction manual. Also available as valve tester minus multitester ranges—Model 45 A-S.

PRICE £39/17/6 Plus sales tax.

IMMEDIATE DELIVERY

MODEL 75A

RANGES 20,000 ohms per volt A.C.—D.C.

D.C. Volts	A.C. Volts	A.C.-D.C. Current	Decibels	Resistance
0—0.1	0—1	0—50 uA	—30 to —5	1—50—10,000 ohms
0—2.5	0—2.5	0—5 mA	—22 to +3	1000—50,000—10 Megohms
0—10	0—10	0—50 mA	—10 to +15	*10,000—500,000—100 Megohms
0—50	0—50	0—500 mA	+4 to +29	
0—250	0—250	0—5 Amps	+18 to +43	*With external battery.
0—1000	0—1000		+30 to +55	

This is a robust 20,000 ohms per volt 50 range universal multimeter designed for accuracy and stability. Fitted into an attractive case, the meter is provided with instantaneous OVERLOAD PROTECTION. The clear, easy to read scale has a length of 4 inches. An internal buzzer is provided for quick continuity tests. Complete with test leads.

PRICE £19/15/- Plus sales tax.

MODEL 120A POCKET MULTIMETER

RANGES 1000 ohms per volt A.C.—D.C.

D.C. Volts	D.C. mA	A.C. Volts	Resistance
0—0.25	0—1	0—10	0.5—20—2000 ohms
0—10	0—10	0—50	50—2000—200,000 ohms
0—50	0—50	0—250	*500—20,000—2 Megohms
0—250	0—500	0—500	*5000—200,000—20 Megohms
0—500		0—1000	
0—1000		0—2500	*With external battery.
0—2500			

This is an accurate pocket size instrument using a robust, sensitive meter movement fitted with instantaneous OVERLOAD PROTECTION and is housed in a high grade moulded case. All resistors used for voltage and current ranges are adjusted to an accuracy of 1%. Supplied complete with test leads.

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CYCLOTRON IS VITAL TO RESEARCH

ONE of the most valuable atomic research tools is the atom smasher known as the cyclotron. Sketched here in diagram form are some of the basic elements of the yclotron completed recently at the British research centre of Harwell. Details of the cyclotron were released arly this year.

The Harwell cyclotron is of a new ype known at the frequency-modulation cyclotron, or synchro-cyclotron. t is an instrument of research only nd is not capable of producing useul atomic energy . . . or an atom-bomb!

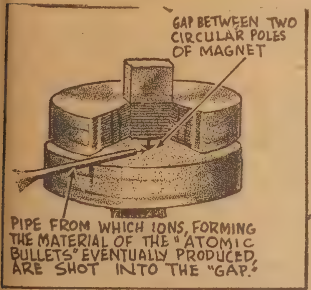
In a strong magnetic field charged particles travel in circular orbits, and his fact has been used as the basis or the cyclotron. The path of such particles can be adjusted so that they circulate inside two large electrodes. An oscillating voltage is applied to hese electrodes and the particles are ccelerated each time they leave one electrode and enter the other.

VACUUM-TIGHT BOX

In the cyclotron a vacuum-tight metal box containing the two electrodes (the D box) is placed between he upper and lower poles of the magnet.

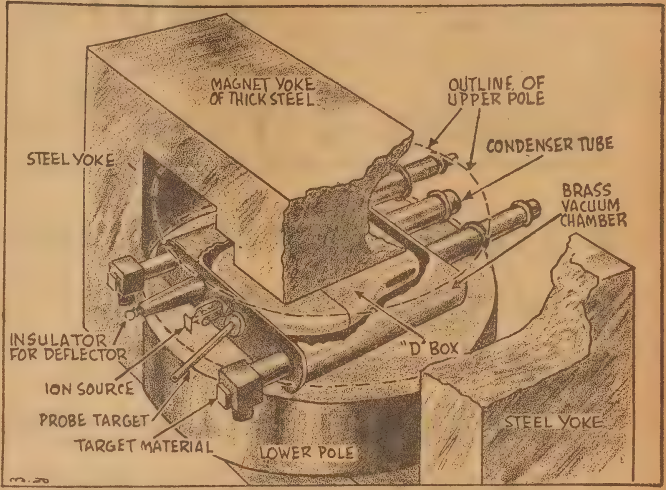
The ions that create the stream of "atomic bullets" are produced by removing the hydrogen atom's single electron, leaving the core of the atom.

When the stream of ions is introduced into the magnetic field they begin to spin around, being successively attracted and repelled. The speed is increased by applying, twice per revolution, an accelerating voltage from a short-wave radio oscillator.


GAP BETWEEN TWO CIRCULAR POLES OF MAGNET
PIPE FROM WHICH IONS, FORMING THE MATERIAL OF THE "ATOMIC BULLETS" EVENTUALLY PRODUCED, ARE SHOT INTO THE "GAP."

The trajectory of the particles becomes a spiral within the electrodes. As the particle gains voltage it goes faster, and the faster it travels the more difficult it is for the magnet to force it into a circular path. As a result, the particle describes circles of larger and larger radius and is constantly accelerating as it does so.

As the speed increases the ions escape from the D box and come into collision with the target material—the piece of metal under experiment.


MAGNET YOKE OF THICK STEEL
OUTLINE OF UPPER POLE
CONDENSER TUBE
STEEL YOKE
BRASS VACUUM CHAMBER
INSULATOR FOR DEFLECTOR
"D" BOX
ION SOURCE
PROBE TARGET
TARGET MATERIAL
LOWER POLE
STEEL YOKE

Magnificent apparatus has been developed to investigate the structure of the atom, which is a tiny entity well prepared to resist attack. Other atom particles, the smallest known, are used as projectiles to "shoot" at the atom, and the rapid-fire guns that project them at velocities of hundreds of millions of miles an hour, have come to be known as atom smashers. Smashing the atom is, however, scientific dissection.

To deflect the particles to an external target so far from their natural orbit requires a large voltage in the deflector, but the disadvantage and difficulties of keeping so high a voltage on the deflector are far outweighed by the advantage of an easily accessible target.

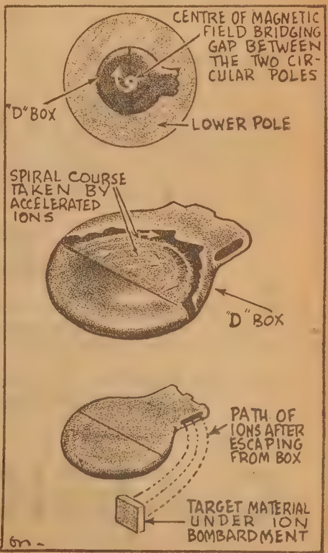
Because it is desirable to have the target readily accessible the target chamber is welded on to the tank wall. A vacuum gate shuts the target chamber off from the main vacuum box when the targets are to be changed.

ATOM STRUCTURE

This makes it possible to bombard many different targets in rapid succession without loss of the main vacuum.

When the target metal is struck by the stream of ion bullets its atoms undergo immediate change. The ion bullet enters the atom, knocking out a neutron. The atomic structure is thus reorganised and the material changed. A piece of copper, in which each atomic core contains 29 protons and 34 neutrons, becomes radio-active zinc whose atomic core consists of 30 protons and 33 neutrons. In less than an hour the new radio-active zinc will return to copper by its own action in "pushing out" the invading proton bullet and replacing it with a neutron.

The cyclotron is housed within walls of thick concrete in order to restrict the circulation area of the dangerous neutrons produced by its action. It is operated by remote control and no one is near it when it is operating.


CENTRE OF MAGNETIC FIELD BRIDGING GAP BETWEEN THE TWO CIRCULAR POLES
"D" BOX
LOWER POLE
SPIRAL COURSE TAKEN BY ACCELERATED IONS
"D" BOX
PATH OF IONS AFTER ESCAPING FROM BOX
TARGET MATERIAL UNDER ION BOMBARDMENT

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Complete 8 Valve Radiogram - Unit

- 8 VALVE WORLD-RANGE RADIOGRAM-UNIT
- MATCHED-DUAL SPEAKERS—12" and 8"
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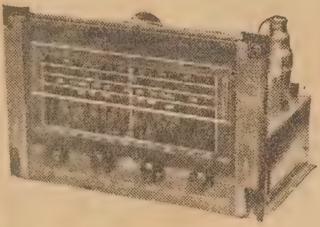

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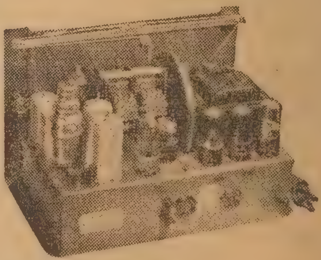

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SPECIFICATIONS AS EIGHT VALVE UNIT, BUT WITH SINGLE 6V6GT OUTPUT VALVE AND SINGLE 12" SPEAKER

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245 PARRAMATTA RD.
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NEWS AND VIEWS OF THE MONTH

Television Aerials

ONE aspect of the coming television era which must be given a great deal of attention is the provision of aerial systems.

Overseas this aerial business has received a great deal of attention, so much so that virtually a small industry has grown up in their design, provision and erection.

If a clear and interference-free picture is to be enjoyed it is apparent that a strong signal must be fed into the television receiver, strong enough to over-ride possible interference and avoid the possibility of unwanted marks appearing on the screen.

Experience has shown that imperfections in the picture have a greater nuisance value than imperfections in sound. Moreover, our ears have been accustomed to odd little noises appearing on the radio from time to time and have grown used to accommodating them.

With television, however, it is quite different—there is really no parallel. The sudden appearance of blotches, streaks and all kinds of strange things, to say nothing of effects similar to those experienced when a film has run off its sprockets, has the most uncomfortable and disconcerting effect on the recipient.

Thus, while in some areas an odd piece of wire may do the trick where reception is very strong, special aerial systems are a virtual necessity where the set is located near the edge of the service area or where interference is experienced.

DIRECTIONAL EFFECT

The effect of a directional aerial, generally composed of several metal rods arranged one behind the other, is to give on effective amplification of the station's signal and to confine reception more or less in one direction.

Apart from the greatly increased signal strength which may be obtained, the aerial's pronounced directivity tends to reject signals or interference which may be arriving from points outside the effective reception area of the aerial.

The ideal aerial, therefore, and one which may be required in quite a few cases, is an array of the type mentioned, erected as high as possible. In practice this will no doubt mean the eaves or the roof of a house, or even a light pole erected for the purpose.

The degree of cost and complexity of such aerials will vary in individual cases, so that an installation service will really be part of the proposition when a television set is bought.

For flat dwellers many problems may come with an aerial installation, as the owner of the flats may have something to say about a host of aerials being plastered all over it, and insurance companies are also interested.

If the television station is erected near the city area, or in such a position as to favor the metropolis with a strong signal, this problem will be eased by the less elaborate aerial systems which will be required. Bearing in mind the large population concentrated within a few miles airline of the GPO it is highly probable that a strong signal in this region will be a major consideration in selecting a site.

The present FM station, for in-

RADIO CROSSWORD PUZZLE, No. 37

ACROSS

1. Type of current.
4. Type of oscillator.
7. Type of aerial coil.
9. He tries out sets.
11. Arrogant.
12. Single thing.
14. Type of radio-active rays.
15. Resistance in which work is done.
16. Slippery fish.
18. Precious stones.
20. Line to antenna.
23. For hearing.
24. Record.
25. Tools.
27. Angle.
28. Put turns on former.
29. One who transmits.
30. Type of motor.

DOWN

1. Type of oscillograph.
2. Sell goods.
3. Applaud.
5. Connects to diaphragm.
6. Type of microphone.
8. Meter end.
9. Resonate.
10. Knots.
13. Sound variations.
14. Pass some current to ground.
17. Wavelength measurements.
18. Valve element.
19. Outer part of conductor.
20. Winged.
21. Two element valves.
22. Valve element.
25. Get weak.
26. Type of wave.

BELOW—LAST MONTH'S SOLUTION

P		D		I		C	R	E	V	A	S	S
A	N	I	O	N	S		I		B		E	
D		P		K		S	C	R	E	E	N	S
D	I	O	D	E	S		E		A		D	
E		L		R				I	M	P	E	L
R	E	E	D		B	A	R		S		R	
S		S			E		I			T		T
	S		G		L	A	G		S	H	O	W
L	O	R	A	N				M		O		E
	U		L		A		D	E	G	R	E	E
A	N	T	E	N	N	A		T		I		T
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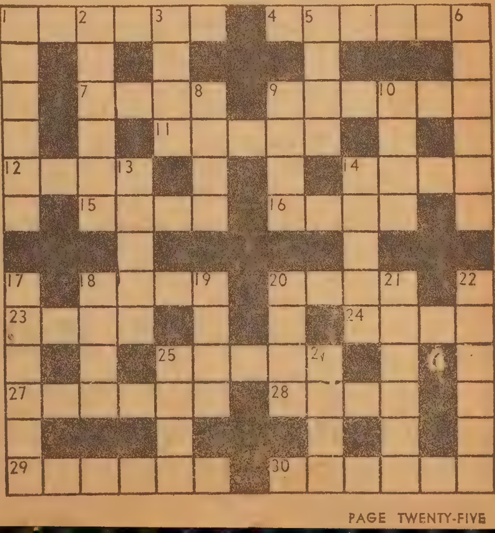
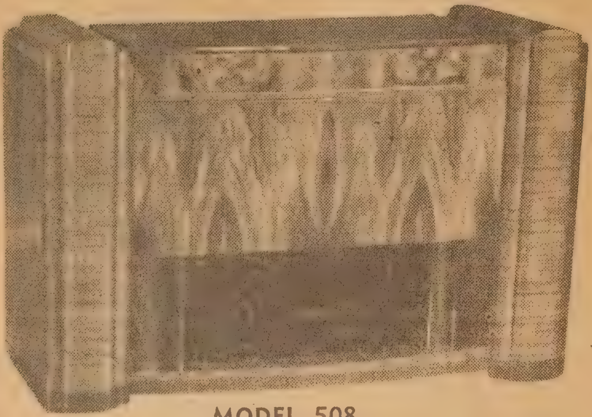


Filling a long felt want—

Slade's Radio Pty. Ltd.

makes available to Radio Dealers and Home Constructors a full range of Console Radiograms and Combinette Cabinets.

Made from best quality Maple and Italian Walnut-veneers, finished with a brilliant piano finish.



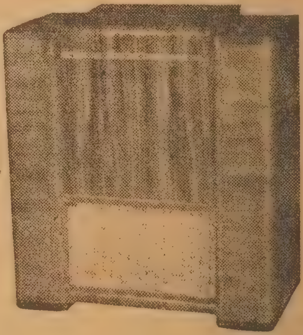
MODEL 508

Model 508 is suitable for all types of Record Changers.

Model 509 is suitable for Single Motors. Dial fits on front of Cabinet Lid being lifted only for record playing.

Model 510 is a Combinette type Cabinet large enough to take a 5 Valve D/W Set with a Single Motor.

EXPERT PACKING FOR OUT OF TOWN DELIVERIES.



Model 509

Let Slade's Radio or their Suburban Dealers show you how cheaply you can convert your old Radio Set into a modern Radiogram.

DAILY DEMONSTRATIONS OF FREQUENCY MODULATION AT OUR FACTORY

SLADE'S RADIO PTY. LTD.,
Lang Street, Croydon, N.S.W.—Tel. UJ5381-5382.

ESTABLISHED ———— 30 ———— YEARS.

stance, gives really solid programmes under similar circumstances from its position at North Sydney and may be taken as a pointer to this.

Fortunately, the erection of a good aerial is not outside the ability of a reasonably versed radio amateur, but for those with no technical knowledge it would be wise to have a suitable aerial erected with the set installation. This is particularly true if elaborate aerials are involved, as there is quite a bit of work and testing required to obtain full efficiency from them.

* * *

Automatic diagnosis

A SMALL news par in the daily press referred recently to a method under development whereby certain diseases could be diagnosed and treatment prescribed by electronic means.

The basic idea is that persons radiate waves which vary according to their state of health. When the radiations denote that some ailment or disease is present, various drugs are brought within the field between the patient and the diagnosing machine and note taken of how the radiations from the drug interact with those from the patient.

At first glance the idea is likely to be discounted as far-fetched, but it is by no means illogical. Indeed it is more illogical to believe that doctors must forever rely on the present methods, which involve a good deal of trial and error.

Every day our understanding of electronic radiation becomes more intimate and it is not at all unthinkable that a definite electronic pattern will be established for many ailments and diseases, allowing them to be measured with the same detachment and precision as the voltage in a radio set.

Along similar lines great progress has already been made in classifying brain currents and telepathic effects may soon cease to be a drawing-room riddle. It was revealed recently that a London brain specialist, after examining the brain current patterns of a subject, classified him as a possible murderer. Almost exactly twelve months later he did, in fact, commit murder. Unfortunately for the subject and his victim the observations of the specialist had to remain a scientific secret until after the trial.

* * *

Amateur transmissions

ONE regrets to note that amateur operation, particularly on 7 and 14 mc, is not always what it should be. Despite many cautions and encouragement to the contrary, much matter is transmitted from time to time which does not do credit to the station operators, some of whom have been in the game quite long enough to know better. The highly objectionable practice of breaking in on transmissions with facetious remarks, for instance, seems to have gained new life of late.

It's a poor example to the many new amateurs and very poor operating. With many others we sincerely hope it will die a quick and early death.

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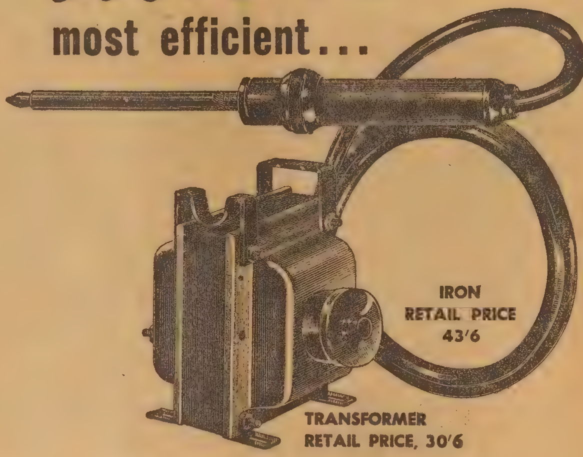

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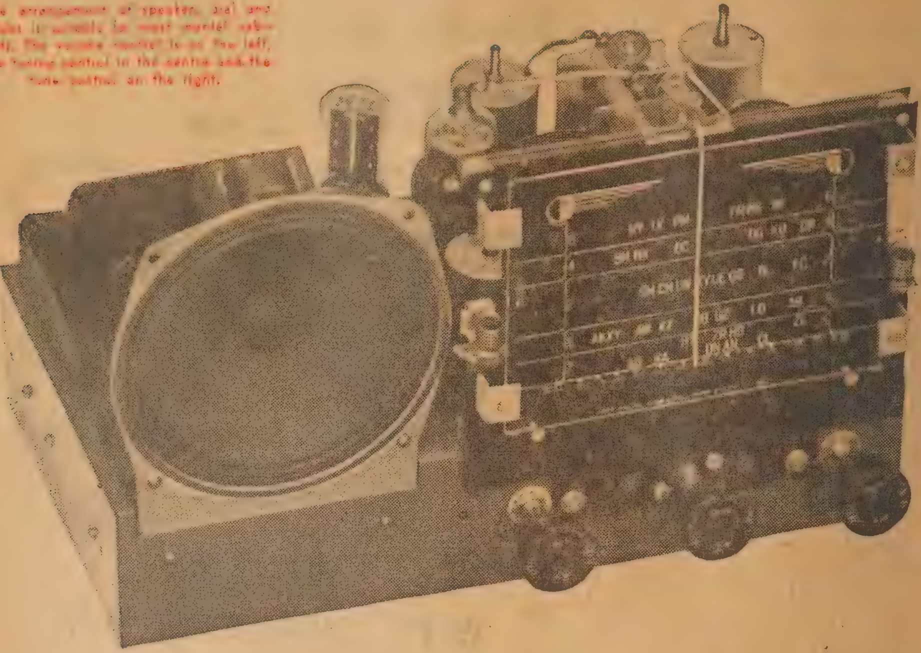


The arrangement of speaker, dial and knobs is suitable for most mantel cabinets. The volume control is on the left, the tuning control in the centre and the tone control on the right.

THE CASE FOR REFLEX SETS

Despite inherent design difficulties, the prospect of obtaining something for nothing has caused the subject of reflexing to come up again and again. In this article, we discuss the problems of reflexed receiver design and finally present an excellent circuit which we have built and tested in our laboratory.

by Maurice Findlay

THE term "reflex" infers that one valve is used to amplify simultaneously at two different frequencies. For example, it is possible, in a superhet, to use a pentode valve to amplify the signal at the intermediate frequency and then, after detection, to use the same valve to amplify the audio component. Thus, the benefit of two stages is obtained but with only one valve.

In more recent times, a number of commercial receivers incorporating a reflex amplifier have been marketed and a typical circuit is shown in figure 1. Here the valve, normally an intermediate frequency amplifier, is also arranged to amplify at audio frequency.

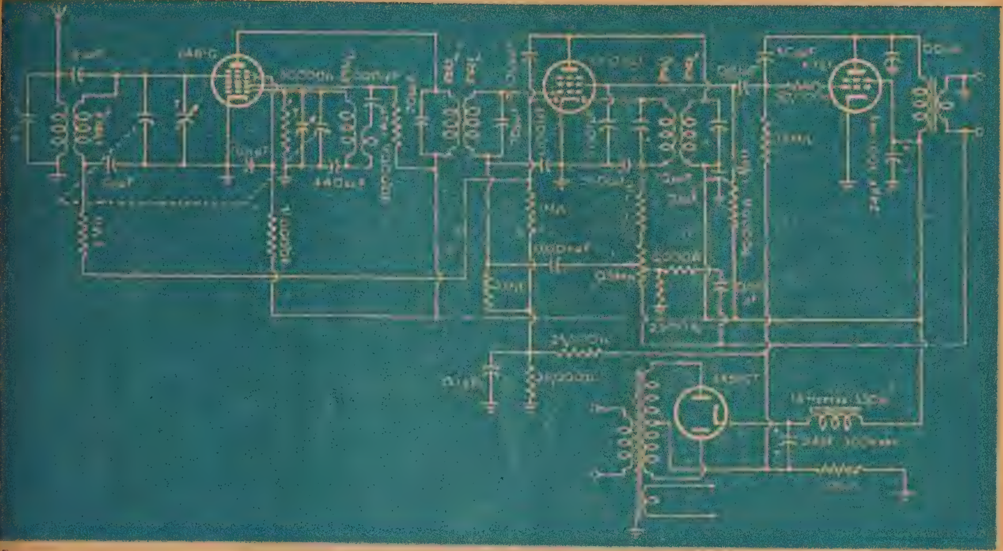
The valve used in this case is a 6B7S duo-diode pentode which is a direct equivalent of the more modern 6G8-G. As can be seen from the diagram, the IF output from the mixer is fed into the grid of the valve, just as for a conventional IF amplifier, and appears at the diode detector plate by the normal process.

After passing through the usual filter network, the audio appears across the diode load, which in this case also happens to be the volume control. From the moving arm of the volume control, the audio is taken back to the grid of the 6B7S.

The presence of the IF transformer in series with the audio circuit is of no importance, since its impedance at audio frequencies is negligible. Similarly, the audio load resistance in the return circuit of the IF transformer does not prejudice its operation to an extent worth considering, since a suitable bypass condenser is included. The bypass condenser is chosen so that it is effective at the intermediate frequency but has only a minor effect on the audio signal.

A similar state of affairs exists in the plate circuit. The IF transformer winding does not present any appreciable impedance to the audio signals, which therefore appear across the load resistor in the plate circuit. The load resistor is suitably bypassed for IF.

You will have realised that the foregoing can only be true if the IF is sufficiently far removed from the audio range that the bypass condensers across both the grid and



This reflex circuit, from the AWV Co. is intended mainly for factory production. Certain special features make it less suitable for home constructors. Note that the two 25,000 ohm resistors in the B minus lead should read 250,000 ohms.

such as in the case of a bedside radio, it is most troublesome.

The minimum volume effect is due to the pentode operating after the manner of an anode bend detector. (See figure 2). Due to slight non-linearity in the plate characteristic, heightened by the necessarily unfavorable operating conditions, a small portion of the IF signal is "detected" and appears across the audio plate load, irrespective of the setting of the volume control. This is the source of the output with the control turned full off.

When the volume control is advanced, anti-phase audio voltages which have been detected normally by the diode detector also appear in the plate circuit and the two tend to cancel. Complete cancellation does not result because of the differences in the detector characteristics and the result in the output is a distorted signal composed mainly of harmonics of the fundamental audio signal.

LINEAR OPERATION

In the commercial receivers, which appeared with reflexed amplifiers, care was taken to see that the valve operated under the most favorable conditions of bias, input HVC, &c. Even so, the minimum volume effect was still present and was simply accepted as a defect of the particular type of circuit.

With the introduction of high gain diode-pentodes such as the 6SF7-GT and the 6AR7-GT it became possible to achieve quite a high audio gain with a low value of audio load resistor. The low audio load meant that the operation of the stage of intermediate frequency was not greatly effected and also the minimum volume effect was somewhat reduced.

A circuit employing this idea was published by the Amalgamated Wireless Valve Co. in their technical bulletin, Radiotronics, some years ago. It employed a 6SF7-GT reflexed amplifier, the audio load for which was reduced to 15,000 ohms. With this load the 6SF7-GT gave an audio gain of about 12.5 times.

The overall sensitivity of the set was increased to somewhere about 40 microvolts for 50 mW output as compared with about 300 microvolts for a "straight" receiver using the same valves. This is quite a worthwhile increase and makes the set adequate in locations where it would be rather insensitive without the reflexed stage.

This Radiotron circuit incorporates a number of other interesting features, the most notable of which is

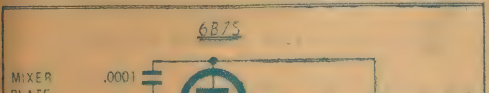


FIG. 1.

A typical reflex amplifier. The overall gain may approach that of two separate valves, but distortion at high signal levels and "minimum volume effect" are serious disadvantages.

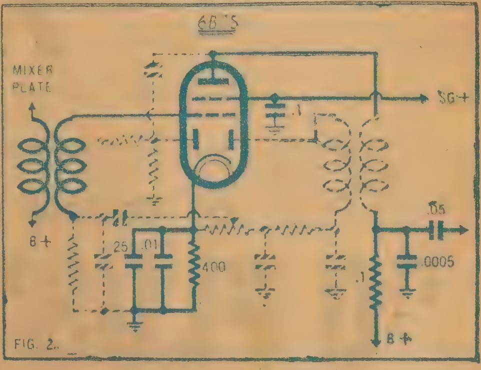


FIG. 2.

A reflex amplifier contains all the essentials of an anode bend detector so that some audio signal can appear at the grid of the output valve irrespective of the setting of the volume control.

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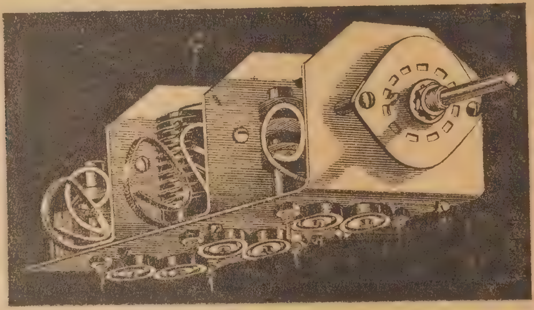

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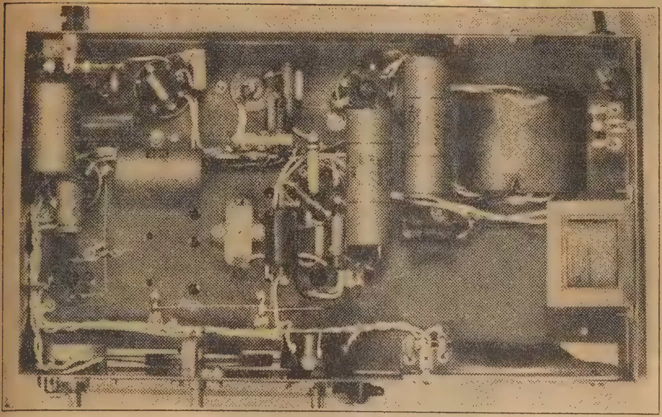

The layout of major components both above and below the chassis can be seen from this photograph.

the application of approximately one tenth of the total available AVC voltage to the 6SF7-GT to give a very smooth AVC characteristic.

However, the minimum volume effect was still present with this receiver, even if to a much smaller degree.

A recent issue of Radiotronics includes the circuit of yet another reflexed receiver which largely solves the problems usually associated therewith. The receiver, designated RD34, is reproduced here as a matter of interest.

AUDIO FROM SCREEN

One of the interesting features of this circuit is that the audio is taken from the screen, rather than the plate, of the reflexed amplifier. At IF the valve behaves as a pentode, while it behaves as a triode with respect to audio frequencies.

With this arrangement the valve can perform its function as an IF amplifier without interference. The screen dropping resistor, which is necessary in any case, also serves as an audio load. It is necessary, however, to use a fairly low value of screen bypass condenser to reduce high frequency audio attenuation.

In the RD34 circuit the minimum volume effect is minimised by a system of negative feedback, which operates in the volume control circuit and also provides a measure of tone compensation. The voice coil winding is involved in the feedback circuit and a tapped potentiometer is required.

Where sets are to be mass produced, the special component and circuitry is not likely to present a problem, but there are unsatisfactory features in the circuit for home constructors.

By way of experiment, we built up a receiver in our own laboratory using a 6AR7-GT as a reflex mplifier with a screen load resistor. Not wishing to use a tapped potentiometer or become involved with the speaker voice coil we omitted the negative feedback of the RD34 circuit and included instead negative feedback between the plate of the output valve and the screen of the 6AR7-GT.

With this arrangement we hoped to realise a worthwhile increase in gain and at the same time reduce the minimum volume effect to negligible proportions. However, by the time the effect was reduced to what we considered a satisfactorily low level the overall gain was little higher than for a straight set.

Obviously this was not a solution we wanted, so we decided on another line of attack.

A potentiometer was wired into circuit to control the RF gain of the set manually while the negative feedback was omitted from the audio amplifier. Apart from the control being rather critical the idea worked well, allowing the full gain of the set to be realised without any sign of "minimum volume" effects.

LEVEL LIMITED

Since the signal level at the detector is automatically limited, distortion due to non-linearity of the amplifier ceases to be a problem.

Of course the manual gain control is less smooth than the more usual AVC arrangement. However, with modern aerial coils, the gain across the broadcast band is fairly even and only slight adjustment of the gain control is necessary when tuning from station to station in the average location. The omission of AVC is only likely to be a serious disadvantage unless your location is bad for fading signals.

We were able to improve the action of the volume control by applying only part of the control bias to the 6AR7-GT. With the final circuit, only one-third of the developed bias is applied but, since it is effective at both intermediate and audio fre-

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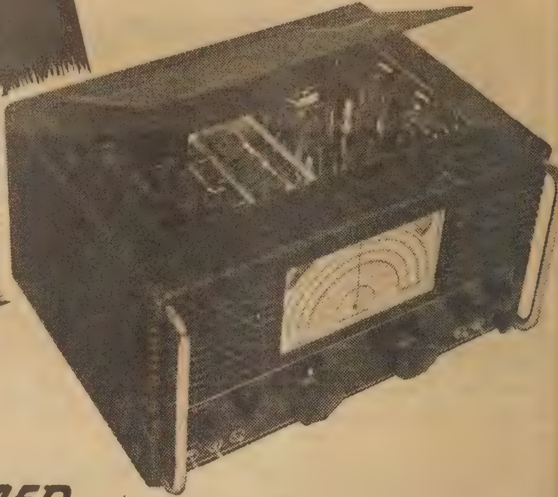

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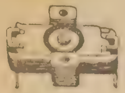

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quencies, the control is very effective.

The volume control circuit is so arranged also that the primary winding of the aerial coil is shunted as the potentiometer is turned towards the "off" position. The shunt resistor has little effect on the aerial coil when the control is well advanced, but ensures smooth operation when the set is used close to a powerful transmitter.

The remainder of the circuit is along fairly conventional lines. To avoid the necessity for two separate dropping resistors and bypass condensers, both screen and oscillator plate of the converter are operated at from 100 volts. Normal operating potential for the oscillator plate is 200 volts but, for broadcast-band operation, the lower voltage is perfectly satisfactory.

In a dual-wave design, a much more rigid approach to the converter circuit would be necessary.

BASE RESPONSE

The coupling condenser between the detector and the grid of the 6AR7-GT is deliberately on the low side. Good response in the extreme bass register is not a feature of small speakers mounted in a mantel cabinet, so that the effective power output can be increased by concentrating the energy within the normal range.

Hum output from the set is low and is not likely to be noticed, except under extremely low-level listening conditions. If you contemplate using the design for a bedside radio, it would be permissible to include negative feedback, in which case, the hum level can be made virtually non-existent. This can be achieved by connecting a 0.5 megohm resistor between the plate of the 6V6-GT and the screen of the 6AR7-GT.

Incidentally, a built-in on/off switch is a very handy feature on a bedside radio. It would be a simple matter to use a switch type potentiometer for the tone control and wire the switch to break one of the main leads.

POWER SUPPLY

With a fairly large chassis in use, there is little point in restricting the size of the power transformer. We arranged the bias on the output valve so that the total drain of the receiver is within the ratings of a 60 mA transformer but, if you happen to have an 80, or even a 100, mA 285-volt transformer on hand, there is no reason why it should not be used.

With a large transformer, the internal resistance of the windings is quite low and the high tension voltage may tend to run a little on the high side. For this reason we suggest that you choose a filter choke with a fairly high internal resistance. Anything between 300 and 600 ohms is suitable with preference for the higher value if a large transformer is used.

If you use an 80 mA or larger transformer, the 300 ohm back bias resistor could be reduced to a minimum of about 250 ohms to provide

(Continued on Page 73)

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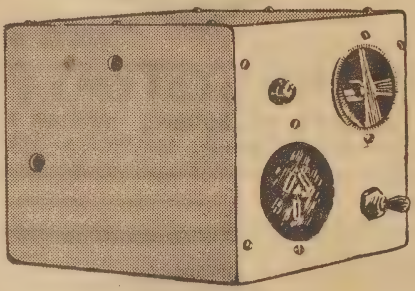

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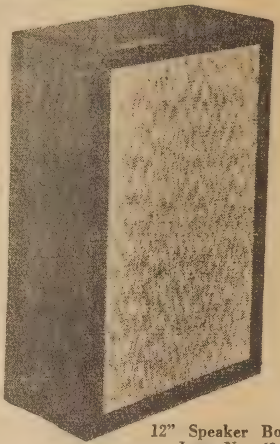

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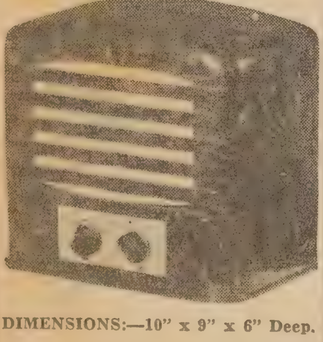

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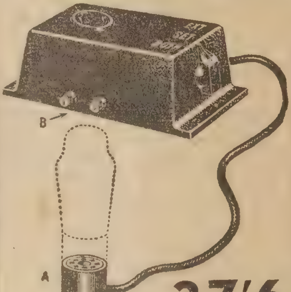

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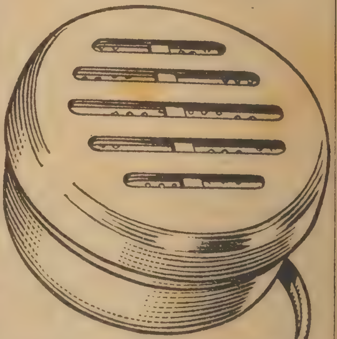

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inductance and a limited amount of distributed capacitance. Modern coils with honeycomb windings and variable iron slugs are very satisfactory in this respect, and they can be used with almost any dial-condenser combination. Some of the very old coils, on the other hand, are not so accommodating, and there may be some difficulty in getting them to cover the whole band, provided for on modern dial scales.

By and large, however, the chief requirement is to select the right gang and dial combination. Most coils will combine satisfactorily with any one of them.

Would it be possible to use a 3-gang on a set which normally requires a 2-gang? Which sections should be used and what would I do with the vacant one?

There's no objection at all, Tom, to using a 3-gang, provided it can be fitted on to the chassis and that it matches up with the dial you plan to use. In other words, if it's an "H" gang, you will need an "H" dial.

USING SECTIONS

It does not matter much which of the three sections you use, the obvious plan being to use the sections which are closer to the connecting points in the circuit. The remaining section will simply be ignored.

It would not be possible to use all three sections unless the whole circuit were re-designed to provide for an R.F. stage or a pre-selector. This latter idea had many points to recommend it, but it has disappeared in the general tendency to save expense and make sets as simple as they can be.

I have seen several references to a loudspeaker filter, which cuts off everything above 4½ kc. What would be the difference in results between a high-fidelity set using this and one with an I.F. channel 4½ kc. wide?

We better get a couple of terms straight first, Tom. For a receiver to handle all sidebands up to 4.5 kc. properly, the pass band would have to be 9 kc. overall—that is, 4.5 kc. either side of reference. This is probably what you have in mind, so we'll base our assumption on that suggestion.

BAND PASS

If we were concerned only with radio programmes, and IF the pass band was a sharp 9 Kc., and IF the distortion in the audio system was low, there would be no difference to speak of between the two types of set.

However, only the third "if" can be admitted as a likely possibility. Enthusiasts who are keen on sound reproduction generally have a record collection and the receiver or amplifier must be designed on this basis.

The basic idea of the filter you refer to was to allow worn or distorted records to be played on wide range equipment and it is very valuable for this purpose. It can be used in the same way on radio programmes but, for various reasons, it is not required to the same extent.

However, using a 4.5 Kc. filter, the programme would sound essentially the same as if it were run through an IF channel cutting off everything above 4.5 Kc.

But this brings us to a second point, namely that the selectivity curve of a practical IF channel is normally rounded in form so that there is no distinct cut-off frequency. A channel which seriously attenuated modulating frequencies at say 5 Kc. or above, would normally show a good deal of attenuation at 2 or 3 Kc.

Against this, the audio filter you refer to gives a normal response to within a few hundred cycles of its cut-off. In other words, it lets a lot more useful audio through the pass band than does a conventional sharp IF channel.

Still referring to the 4½ Kc. filter, would the effect on selectivity be the same? In other words, would a broad set plus the filter be as selective as a naturally sharp set?

Only under very special circumstances would the answer to this question be "yes."

If a set is broad enough, it will pass two or more signals through to the detector simultaneously and you will hear two or more programmes. One may conceivably be weaker than the other but they can both (or all) be there.

FILTER ACTION

The individual programmes will contain all the normal frequencies and the only acton of the filter, after the detector, will be to restrict the response of the two lots of modulaion to frequencies below 4.5 Kc.

The exception we referred to would be the case where a receiver with borderline selectvity might pass one signal complete plus the outer sidebands from an adjacent signal. These outer sidebands can cause high frequency "monkey chatter" which would largely be eliminated by the audio filter.

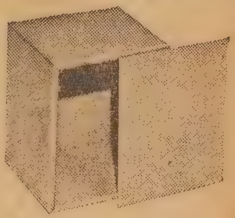
As a general observation, restriction or "selectivity" in the audio channel can only improve the station-separating qualities of a set when the tuning section itself has a high degree of selectivity.

I have seen many references to tropic-proofing of radio sets. Is it a good idea and, if so, where could I get the necessary materials?

Tropic-proofing is not only a good idea, Tom, but it is an essential treatment in certain parts of the world. Fortunately this does not include the southern parts of Australia, so you probably don't need to worry too much about it.

In the north of Australia it is a different story and, if you are in doubt about a particular location, Tom, have a talk with your local retailer or serviceman. He will doubtless have a good idea as to how much trouble is experienced with moisture in local radio sets.

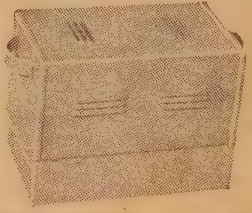
N.H.V.
KITS



Metal Utility Cabinets

This line of cabinets is for housing all kinds of electronic equipment, monitors, frequency meters, multimeters, test equipment oscillators and oscilloscopes. It has a fixed back and removable front cover fastened by nuts and bolts or self tappers. Their finish is in grey.

Catalogue No.	W	D	H	Price plus Sales Tax
AC1	10	5	9	£1 5 6
AC2	12	7	9	£1 12 6
AC3	17	7	9	£1 19 6
AC4	17	10	9	£2 15 0



These streamlined amplifier foundation units are intended to house public address amplifiers, speech amplifiers, and similar apparatus and present a very handsome appearance in grey finish. Each of these foundations consists of a standard chassis with removable top in aluminium. Fitting over the whole is a removable cover which has louvres on all sides and two handles welded on the ends. All units are 9" overall height and each chassis is 3" deep.

Catalogue No.	D	W	H	Price Plus Sales Tax
MC666	6	6	6	7 6
MC569	5	6	9	8 6
MC7810	7	8	10	12 6
MC6712	6	7	12	12 6
MC81010	8	10	10	15 6
MC81112	8	11	12	19 0
MC7915	7	9	15	19 0

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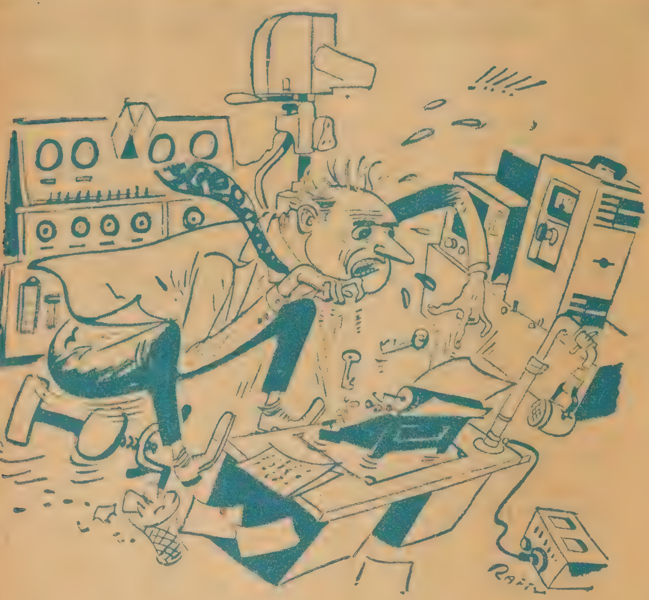

Let's Buy An Argument

I'm just a little disturbed and upset by the results of last month's attempt to "buy an argument." Expecting by now to be hung, drawn and quartered, it comes as an anti-climax to find myself still alive and kicking, even offered a degree of moral support. But "nil desperandum", there may yet be those capable of breathing out sulphurous fumes and writing with pens dipped in vitriol. Let's hear from you!

HOWEVER, Mr. Boswell does manage to brand my ideas as "absurd" even though his letter is marked by a good deal of Old World restraint. In particular, he objects to the reference to distortion.

I suppose I did leave myself open to criticism on this score in an effort to take a technical short-cut. Let's see if we can retrieve the situation.

DISTORTION

Distortion can be classed under at least four major headings, with numerous sub-sections, and with riders to the effect that distortion type 4Q is twenty times as objectionable to the ear as type 4W, while distortion type 3F can only be detected by using a super-sniderscope, or some equally fictitious device.

Had I stopped to wade through all this the trend of the argument would have been lost forever.

The point I was trying to make is that the input signal or the speaker-to-ear circuit are both likely to contribute far more distortion of any one kind than a well-designed amplifier. And what is true singly of any one kind of distortion is true of them all collectively.

But what about the mention of 10 per cent at input and output? Is the figure really absurd?

To be perfectly frank, I can't quote chapter and verse to prove the point. What's more, I know of no method by which it would be possible to measure the distortion actually present in an orchestral recording. What I can do is to quote observations which appear to bear out my "absurd" suggestion.

GROOVE DISTORTION

In the first instance, I rang one of Australia's best-known radio engineers and asked for his estimate of the distortion level to be expected from an average commercial shellac pressing, played with a good average wide-range pickup.

After pointing out the difficulties of saying anything at all, he suggested that there might be from 2 to 5 per cent harmonic distortion in the signal groove actually impressed on the master disc. The total distortion would inevitably be increased by subsequent processing to evolve the working die, a good deal thereafter depending on the nature of the recording material used for the release "prints."

Coming to the pickup, distortion arising from needle-to-groove fit and tracking error might run anywhere from 2 to 10 per cent, not counting sub-multiples of the resonance, with a further 1 to 5 per cent coming from the copper and iron circuits of the head itself.

In the average case, he said, "your estimate would be very conservative."

Following another line of reasoning, I was present recently at an elaborate I.R.E. lecture where the audience was treated to selections taken from disc, tape and film and played over an elaborate speaker system.

The film recordings, from ordinary release prints sounded pretty good to me and were generally quieter and cleaner than the commercial discs.

FILM DISTORTION

Asked to estimate the distortion level on typical film, the lecturer said that it was possible, by growing grey hairs, to produce at the loudspeaker terminals a signal containing 2 per cent harmonic distortion and, therefore, about 8 per cent intermodulation distortion. Pretty good!

But let something get slightly out of gear, he went on, and the distortion would jump up by 7 or 8 times. In practice they were quite happy to keep the harmonic distor-

(Continued on Page 43)

THESE LETTERS ANSWERED BY NEVILLE WILLIAMS

Dear Sir,

I read with considerable interest the article "Let's Buy an Argument" in the last issue. While I cannot claim professional status to back up my arguments, I feel that some of the statements made by Mr. Williams are extravagant, to say the least.

In particular would I query the suggestion that we have commonly to listen to distortion levels around 10 or 20 per cent. To me the figure seems absurd. Equally absurd is his attempt to avoid specifying the nature of the distortion, since he must know this determines whether or not it is objectionable.

Grant these points and the whole validity of the article collapses.

(K. J. Boswell.)

* * *

Dear Editor,

I agree with Mr. Williams' debunking of many dogmatic views on amplifier design, but I feel that he has not gone far enough. His slighting references to the human ear show that the queer psychology which sets amplifier enthusiasts apart from the rest of mankind, applies to him, too.

The fact stands, that a sound amplifier is intended to be listened to; therefore, the listening instrument, the human ear, is the sole and only judge of tone quality. The "opinions" of a C.R.O. on the matter are entirely irrelevant.

The enthusiast, however, regards his amplifier as a realisation of a day dream of theoretical perfections, which pleases him, because it pleases his C.R.O., slide rule and graph paper. Although one or two watts output is ample for the average home, his creation has to have 12 watts or more. High-pitched screeches and scratches, that make everyone flee in terror, make him swoon with delight over the "wonderful treble response." If his theories say o.k. to the amplifier, his ears are ordered to believe it —and comply. As for the ignorant masses, they just have to be "educated" to appreciate his miracle.

Actually the amplifiers themselves are not to blame. Volume turned down they sound as good as one another, but what a waste of effort and material. For home use, a 2 pentode amplifier, with inverse feedback network incorporating separate bass and treble controls is all that is required for best possible tone at sane levels.

The whole matter is closely related to another point raised by Mr. Williams: The strange discrepancy between radio theory and practice. The fact that radio theory must be wrong on many aspects is explained by the wrong approach of radio men to their science. The final link of an amplifier is the human brain.

And this is where the discrepancy between theory and practice comes in: Theory tells you about distortion in the detector, the driver stage, the output valve, &c., which in a listening test don't show up at all.

(P. Stevens.)

* * *

Dear Sir,

Fundamentally the writer's arguments are, in my opinion, sound and the whole story really boils down to this: Those concerned with the design and manufacture of recording and broadcast equipment must ensure that their products reach the highest and most rigid specified standards that the state of their art permits.

From the customers' point of view, it must be admitted that the tastes of listeners vary widely and the listener is right for, unless he or she is satisfied, no listener, no customer!

Technically, the human ear is extremely tolerant, and, to use a term usually understood, broadminded. Very, very few indeed can detect many of the diversions from true reproduction that do occur in general practice.

As far as practice not agreeing with the theory, how true is your technical editor's final paragraph—There NEVER is and NEVER can be any discrepancy between practice and theory.

(W. H. Murden.)

* * *

Dear Sir,

The article by Mr. Williams in the current issue does a good job of debunking some of the erroneous ideas prevalent today in the field of High Fidelity Amplifiers. My main criticism is that much that is pertinent to the subject is omitted.

The comments on direct coupled amplifiers are well founded but there is one possible advantage accruing from the use of this type of circuit in audio work. I refer to the case where it is required to operate the output valves under fixed bias conditions.

A possible solution of the problem of treble loss due to Miller effect is the use of neutralisation. With push pull amplifiers this should not be difficult to arrange and a little "over" neutralisation could possibly overcome treble losses arising elsewhere in the circuit. However, I prefer to overcome this problem by the more usual method of applying negative feedback.

With reference to the Williamson Amplifier, Mr. Williams, while giving full credit to its excellent characteristics, goes to some trouble to point out that records, pickups, loudspeakers, &c., being what they are, such impeccable performance on the part of the amplifier is largely wasted.

On reading the original article by Mr. D. T. N. Williamson, I was greatly impressed by two characteristics of his amplifier. One is the almost perfect linearity exhibited by the amplifier as a whole, including the output transformer.

The other point is the almost perfect control the amplifier, due to its very low output impedance, exerts on the voice coil of the speaker. This gives rise to another problem not generally appreciated.

In brief, a failing of direct radiator loudspeakers is that the coupling of the diaphragm to the air falls off as the frequency goes down, the point where the coupling starts to fall off depending on the size of the diaphragm.

There is, however, a limit to the size and hence the mass of the diaphragm if any treble response is to be expected and it is usual to accept as a compromise, say, a 12in speaker, and arrange for a considerably increased cone excursion at these low frequencies to obtain the required sound pressure.

This is achieved by a number of ways. (1) Fundamental resonance of speaker on a flat baffle characterised by a very narrow reinforcement band causing "one note bass." (2) A vented enclosure giving two peaks of lower amplitude and thus a wider reinforcement band with less intermodulation. (3) A Helmholtz baffle. (4) Acoustic Labyrinth.

All these systems give a reinforcement over a band of frequencies where used with average amplifiers but what happens when a "Williamson" is the driving source? Due to the high degree of negative feedback and the consequent low output impedance, the various peaks are flattened right out.

If these premises are correct then it would be necessary to precede an amplifier of this type with a controllable bass boost stage. The speaker will have to be well baffled, of course, to isolate the back wave and, bearing in mind that various resonances will be mostly suppressed, it could conveniently be placed in a fairly large enclosure, preferably in the corner of the room.

(H. B. Strantzen.)

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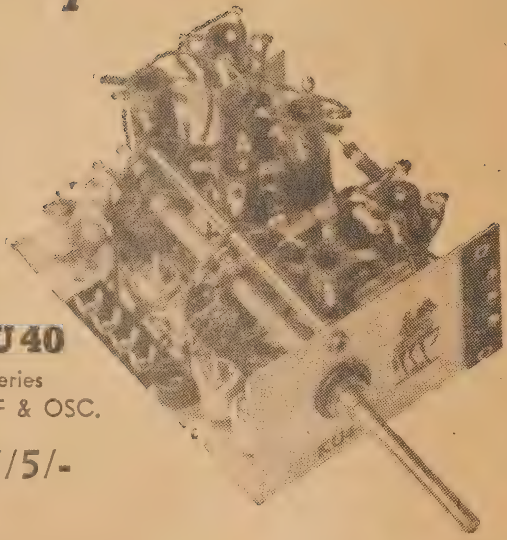

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(Continued from Page 40)

tion to about 8 per cent and presumably the intermodulation figures to about 30 per cent.

Here's the point. If these figures are typical of good average film music, played over a properly adjusted system, what must be the total distortion content of records, radio programmes, pickups, &c., which suffer noticeable distortion?

RECORDING TECHNIQUES

I don't mean by all this that you should proceed to burn your precious record collections. Recording techniques have been improved all along the line and some of the new pressing materials, especially when coupled with microgroove, will usher in a completely new era.

All that I've said has been in an attempt to get the business into true perspective and show up some of the current technical twaddle for what it's worth.

Now for our good friend, Paul Stevens. Reading his letter, I find myself agreeing with a good deal of it, but also find myself identified with two apparent theories:

1. Amplifiers should be designed to entertain the eye, rather than the ear.
2. There exists a mysterious divergence between technical theory and practice.

In actual fact, I didn't suggest the first, and the second is the direct opposite of what I believe.

I am well aware that most listeners are satisfied with a frequency response to 4 or 5 Kc. and, in fact, I often run my own amplifier that way for a spot of unobtrusive background.

But, with all due respect to Mr. Stevens, a bandwidth so restricted is not nearly good enough to enjoy the music in its own right. The demands of a valiant minority, whether eccentric or otherwise, have gradually pushed up standards of reproduction and made better equipment commercially worthwhile.

NO ROSY PATH

Inevitably, anyone who joins this "valiant minority" soon discovers that the path to better reproduction is not a rosy one. He runs up against distortion problems without any clear indication of the source—whether record, pickup, amplifier, speaker, &c.

And this is precisely where I introduced the subject of ears — their ability to identify, evaluate and trace distortion of any kind is very, very limited.

The uninformed simply like or dislike an outfit, without knowing why. The better-informed can suggest possible reasons without being too sure of them. The CRO and the slide-rule are very practical. . . .

"So you don't like it, huh? Give us five minutes, brother, and we'll show you why."

Of course, the reverse may also be true. You fiddle with an outfit till you get the amount of bass and treble you like. The instruments then tell you exactly how much of each there is. Thereafter, every other amplifier can be made just like it, with never a decibel out of place.

In other words, I regard these despised instruments in exactly the same way that a housewife looks on the kitchen scales. They take the guesswork out of cooking, but they don't stop you varying the recipe, or prevent you from enjoying the cake when it's finished.

HARD TO LISTEN?

As for high fidelity being hard to listen to, I take all observations along that line with a very large grain of salt. In fact, I would go so far as to say that REAL high fidelity reproduction is never hard to listen to, and NO process of education is necessary.

The point of the matter is that the term is mistakenly applied to outfits ranging from carpet-beaters to hissing horrors and the rude remarks are generally warranted.

Then there's the matter about theory and practice. I can only repeat the sentiments of last month . . . there never is and there never can be any divergence between true theory and true practice, for the two are expressions of the same phenomena.

The kind of theory which disagrees with practice is the pseudo-theory that I've been complaining about — theory that is obsessed with one idea and progresses to its conclusion by a series of half-truths.

In actual fact, a great deal of study has been given by world-famous engineers to establish relationships between reproduction, distortion and psychological reaction. Far from ignoring the human brain, theory of this order can tell you the precise percentages of any given distortion which will be detected, tolerated or objected to by listeners of differing sexes, age groups and degrees of musical enlightenment.

All this has been inter-related with frequency response, volume limits, reverberation, and so on, by exhaustive listener-reaction tests.

Coupling this with electrical design theory, it would be possible to predict to a high accuracy the reaction of a given audience to a given amplifier system under a given set of listening conditions.

To be brutally honest, very few of us — and I include myself — have the facility or the ability to extract from available "theory" all the practical data we need. Instead, we progress toward the final goal by a variously well- or ill-informed process of cut-and-try.

Mr. Stevens mentions that certain types of distortion occur "in theory" which, presumably, are not apparent "in practice." Here I quote. . . . "This is where the discrepancy between theory and practice comes in. . . ."

Nothing of the kind, Mr. Stevens, there is no discrepancy at all. Theory has already supplied an answer as to the various types of distortion which occur in amplifiers and the relevant percentages which will be audible under a variety of listening conditions. But enough of that!

(Continued on Page 99)

An unsolicited letter

"Walton,"
Elizabeth Street,
Berala.

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Dear Sirs,

The Williamson Amplifier built by you for me exceeds my expectations as far as performance is concerned.

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I have been a lover of good music for a long time and have hoped to own a means of bringing it into the home in undistorted form. My particular liking is for piano music and I find, contrary to my previous belief, that, as well as other forms of sound, can be played without any distortion on my amplifier.

In spite of the fact that my "not-so-modern" permag speaker is not mounted in a vented enclosure, the amplifier reproduces sound, to my children, at a frequency of 17,000 cycles (HMV ED1187).

Thanking you for your very good job.

I am,
Yours faithfully,
J. M. VICKERY.

The above "untouched" letter, is just one of the many similar letters taken from our files, and may be seen at our office at 265 MILITARY ROAD, CREMORNE.

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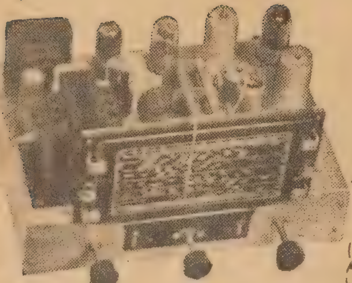

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FROM THE SERVICEMAN WHO TELLS

This month I — your unworthy serviceman — have handed my pen to a very good friend and a very good chartered accountant. Having viewed my own affairs and also checked through what others have written on the same subject, he has prepared an up-to-date series of articles, especially for servicemen, on the keeping of books and records.

RADIO servicemen have a certain specialised knowledge to "sell" to the public and young fellows entering business on their own behalf often do so with a great deal of gusto and enthusiasm.

Midst the efforts to do good jobs and plenty of them, time which has to be spent looking after accounts may often appear to be a dead loss and, in a restricted sense, I suppose it is.

But books and accounts cannot be ignored. Unless income and outlay are constantly under surveillance, it is impossible to be sure about the real progress of the business. Many a venture has failed because the owner forgot overhead expenses and "dead" stock or drew too heavily on the funds for salary and incidentals.

INCOME TAX

But quite apart from all this, the law requires that you furnish a statement to the Income Tax Commissioner each year covering the financial result of operations for the period. A properly-kept set of books is the only complete answer to this requirement.

At the outset, the reader must understand that it is not a difficult matter to keep in order a set of books which will tell you—and the Tax Commissioner—all it is necessary to know about your business. The job need not take up more than half an hour a day. Your records can be self-checking and, should an error occur, it will become obvious immediately and can therefore be located without delay.

The secret of good bookkeeping is accuracy and that simply means being careful. Take care with every figure you put down. Exercise the same care with your books as is necessary with your radio work and you will quickly become proficient.

One could suggest any of a number of bookkeeping "systems" but the most practical one from a serviceman's point of view is also the simplest.

DOUBLE ENTRY

This is known as "Double Entry Bookkeeping." It is the system used by all big businesses today and it has the advantage that it can be applied equally as well to the smallest radio service business as to the greatest industrial combines in Australia.

The significance of the words "Double Entry" is that, every time you make a transaction, you record two entries in the books.

To take a simple example, let us assume that you have sold a radio set for £30. Firstly you would show in your Bank Account that you have received £30. Secondly, in the account which records your sales, you would show that you have sold goods to the value of £30.

In this series of articles I intend to outline a system of double entry bookkeeping which you can introduce into your business immediately.

We will in this article confine ourselves to the first essential—the Cash Book. Later I will deal with other books which you may need in order to keep simple records as your busines expands, but the Cash Book will remain with you right throughout, no matter how large your organisation becomes. Indeed, if ALL your transactions were cash transactions, you would need no other book.

CASH BOOK

You will realise how important this book is when a moment's reflection tells you that the success or otherwise of your business is largely measured by your bank balance. Furthermore, a proper dissection of the Cash Book will show you the state of your business at any one point.

Before we proceed, there are one or two technical terms you should know. These are "Debit" and "Credit." They are generally abbreviated and written as "Dr." and "Cr." The left-hand side of any book of account is known as the debit side and naturally the right-hand side is called the credit side. It is necessary that you fix these two facts firmly in your mind, together with the rule that goes with them—"Debit whatever is received."

Figure 1 gives the layout of a typical cashbook and illustrates the application of this rule. If you look at the debit (left-hand) side, you will notice that all the moneys received by the bank from you have been suitably recorded.

by C. H. Pearce

A.I.C.A.

When commencing a new business, it may as well be done in a right and proper way. The first step is to open a bank account. This means paying all your accounts by cheque and banking all moneys received daily, or as soon as possible after receipt.

You now become an "employee" of your own business. Therefore, draw yourself a salary each week, and ON NO ACCOUNT dip into the till for any personal expenses.

If your business is too small to have a bank account, or no bank is convenient, have your own "bank" in the form of a cashbox kept in a safe place. The important thing is not to get the money relating to the business mixed up with your personal and household money.

From time to time you will probably have small expenses for which it would not be practicable to draw a cheque. To cover such items, you should draw, say, £1 for petty expenses and show that item on the credit (right-hand) side of your cashbook. Keep a note of these petty expenses on a separate piece of paper so you can assure yourself that they have not been spent unwisely.

STARTING OUT

Let's start from the beginning and assume that you are going into business (either full or part time) with a capital of £200. With this amount you intend to buy shop furniture and test instruments and also purchase your initial stock. The first requisite is, of course, the cashbook itself. This can be bought from any reliable stationer for approximately 4/-, depending upon the size. Get one with as many columns as possible, as this will simplify your recording.

Use a separate double page for each month's transactions. When opened, the left-hand page should take care of all your debit entries, while the right-hand page should be a complete record of the credit entries for the month.

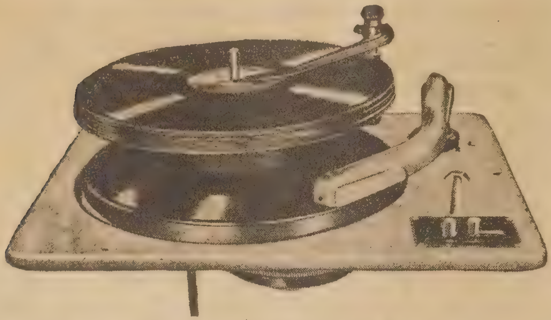
Your next step will be to deposit the £200 in the bank, opening an account in the name of your business. Give your business a name (e.g., The Reliable Radio Service Co.), and draw all your cheques in that name.

CAPITAL

You now record this deposit in your cashbook on the debit side, which is headed "Receipts." The date "October 1" is first written in, then the name of the account (Capital) under the details column, and the amount (£200) is inserted in both the Sundries and Amount of Deposit columns.

Separate columns are provided for transactions which are numerous throughout the month, and a Sun-

two of the best . . .



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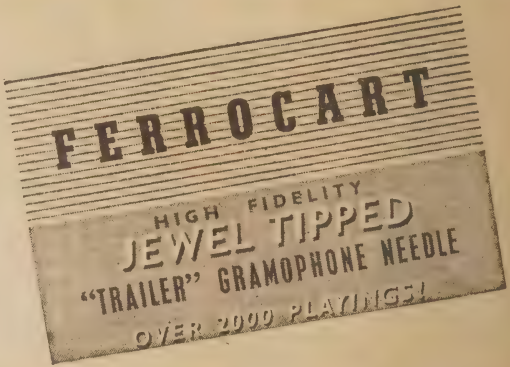
2. Plays nine records, either 10" or 12" as selected.
3. Amazingly quick and easy . . . to load . . . to play singles . . . to reject . . . to unload . . . to stop,
4. Crystal or high fidelity moving pick-up
5. Incredibly light needle pressure.
6. Twin ball-race pick up mounting.
7. Triple twin-spring mounting of entire unit.

The best on record . . .



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EI/2655

CASH BOOK

Dr RECEIPTS

Date	Details	Sales	Service	Sundries	Amt. of Deposit
Oct. 1	Capital			200	200
„ 2	Sales	8			
„ 2	Service		2		
„ 2	Service		2		
„ 4	Sales	15			
„ 5	Sales	3			
„ 5	Service		4		
„ 8	Sales	6			40
„ 12	Service		6		
„ 20	Service		4		
„ 22	Sales	25			35
„ 24	Sales	10			
„ 28	Sales,	15			25
	£	82	18	200	300

EXPENDITURE Cr.

Date	Details	Purchases	Salary	Sundries	Amt of Cheque
Oct. 2	X Radio Co.	50			50
„ 2	Z Furn. Co.—Fittings			30	30
„ 2	Y Radio Co. — Test Instruments			30	30
„ 2	J. Smith—Rent			5	5
„ 7	Self—Salary		5		5
„ 10	"Daily News"—Advertising			3	3
„ 14	Self—Salary		5		5
„ 14	Telephone			5	5
„ 20	X Radio Co.	50			50
„ 21	Self—Salary		5		5
„ 25	Electric Light Co.			2	2
„ 28	Self—Salary		5		5
		100	20	75	195
	Balance in Bank				105
	£				300

Fig. 1.

dries column is used for less frequent transactions.

Whenever you go to the bank with money to be deposited, whether it be one, two or three days takings, always enter the amount in the Amount of Deposit column. Your cashbook thus becomes a copy of your bank account, and you can easily check it with the statement from the bank.

The next day, October 2, you made your first purchase of £50 worth of stock from the X Radio Co. Record this on the credit or expenditure side of your cashbook in the column especially provided for purchases (i.e., purchases for resale), and also in the total Cr. amount of cheque column.

The same day you bought your shop fittings from the Z Furniture Co. These cost you £30. You spent £30 at the X Radio for test instruments, and you paid J. Smith the first month's rent—£5. All these are expenditure items and are recorded in the Sundries and Amount of Cheque columns on the credit side of your cashbook. The cheque numbers should also be shown in the Details column, or you may use a separate column if you have sufficient room.

FURTHER ENTRIES

Also, on October 2 you sold goods to the value of £8. This is recorded on your receipts side in the Sales column. On the same day you carried out two service jobs and received £2 for each of them. These amounts will be entered in the Service column of your cash receipts.

You made further sales of goods on October 4 and 5, for £15 and £3 respectively. In addition, you received £4 for service work on October 5. These amounts would be recorded in the Sales and Service columns.

On October 7 you drew £5 for yourself as salary. This is entered in the Sundries and Total column on the expenditure side.

You received a further £6 for goods you sold on October 8, and this amount you banked, together with amounts received on October 2, 4 and 5, making a total deposit of £40. The £6 is recorded in the Sales column and the £40 in the Amount of Deposit column.

A glance at the expenditure side reveals how you have been spending money. On the 10th you spent £3 on advertising in the local paper; on the 14th you drew a further £5 salary and paid £5 for the telephone.

From the 20th of the month onwards your money was expended on additional purchases, salary, and electric light. You also received further amounts for sales of goods and service work.

The same system you have been using applies to these items, and they are recorded in a similar manner to those outlined above.

We now come to the end of the month. Having made sure that all moneys deposited and all cheques

MONTHLY STATEMENT OF AFFAIRS

Dr. EXPENSES INCURRED IN EARNING INCOME			Cr. INCOME RECEIVED	
Purchases	100		Sales of Goods	82
Less goods in stock ..	50		Service Work	18
	—	50		
Rent		5		
Advertising		3		
Telephone		5		
Electric Light		2		
		65		
Net Income for month		35		
		£100		£100

Fig. 2.

STATEMENT OF WORTH or BALANCE SHEET

Dr. LIABILITIES			Cr. ASSETS	
Capital (See N.B.) ..		200	Cash in Bank	105
Profit	35		Stock in Shop	50
Less Salary already drawn	20		Furnishings	30
	—	15	Test Instruments	30
		£215		£215

N.B.—This Capital is considered as a liability, because the business really owes it to you, since you lent it to the business to start.

Fig. 3.

"VEGA" *little wonders!*

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Miniature I. F. TRANSFORMERS & COILS

(as used by leading Manufacturers)

Giant in performance — dwarf in size — "VEGA" miniature I.F.s give you the greatest GAIN in radio . . . RETAIL 13/9 ea. Miniature coils are also available. Aer, RF. OSC (Specify mixer tube) . . RETAIL 8/9 ea.

MINI CAR RADIO KIT (matched) 57/6
AER, R.F., OSC, 2 IFT'S and "HASH" Coil

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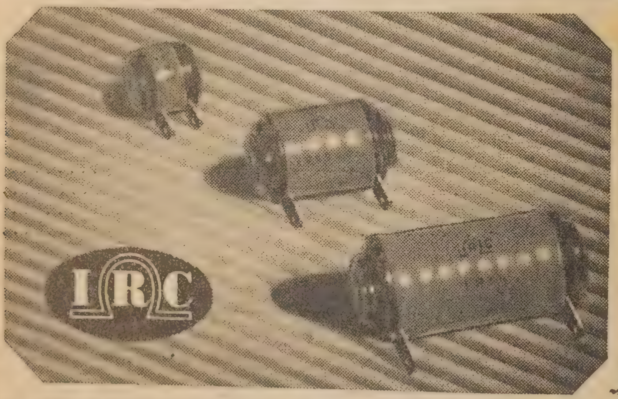

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Standard tolerance of IRC Precision Wire Wound Resistors is 1%, with special tolerances as low as 1/10th of 1% where required.

Non-inductive, low noise level, and impregnation against atmospheric conditions are characteristics of the IRC Type WW units.

Available in all resistance values up to:

Type WW2, any values up to 1.3 meg. (max.).
Type WW5, any values up to 750,000 ohms. (max.).
Type WW4, any values up to 350,000 ohms. (max.).
Type WW3, any values up to 125,000 ohms. (max.).

They meet the exacting demands called for in Talkie equipment, Multipliers and Shunts for Meters, Attenuation Controls, and all applications where low temperature co-efficient, stability and a high degree of accuracy are essential.

Our engineers will welcome the opportunity to co-operate—whatever your resistance problem, bring it to IRC for a speedy, economical solution.

PRECISION WIRE WOUND RESISTORS

SOLE AGENTS FOR AUSTRALIA

Wm. J. McLellan & Co. Pty. Ltd.

BRADBURY HOUSE 55 YORK STREET, SYDNEY. Phone: BX 2508 drawn during the month have been entered, the cashbook is "closed off." That simply means adding up both sides and entering in the balance.

The receipts side tells you that the business has received £300. This is made up of capital £200, goods sold £82, and £12 for service work. The expenditure side reveals disbursements of £195, consisting of purchases of stock £100, salary £20, and furniture, test instruments, rent, &c., £75—leaving a balance of £105.

You can see the advantage of having separate columns for such items as purchases and sales, for this enables you to see at a glance the amount in respect of these for the month without going through the book and picking them out.

Before going on with the double-entry side of the above transactions and showing you how to make up a statement of affairs for the month, I will briefly deal with the entries necessary to record the "trade-in" of a radio set, handled on a cash basis.

TRADE-IN RECORDS

The procedure is not difficult. It is as follows:—

1. Record of Old Set Traded in:

Enter on the expenditure side in the Purchases column the value allowed on the old set. (Give your customer a cheque for this amount.)

2. Sale of New Set:

Record this as a receipt in the Sales column (receipts side). When the old set is ultimately sold, this too will be entered on the receipts side (Sales column).

Figure 2 sets out a monthly statement of affairs. I suggest you prepare one each month and file them for future reference. They will give you a precis of each month's activities.

The statement is headed "Income Received" on the credit side and "Expenses Incurred in Earning Income" on the debit side. You will notice the procedure has been reversed. Purchases which are recorded on the credit side of the cashbook appear on the debit side of the monthly statement. Why is this so?

When you made purchases of stock you did not receive the money, did you? You paid out money; therefore the amount was entered on the credit side of your cashbook. Who did receive the money for these purchases? It was the firm supplying the goods, and so you have debited them in this statement of affairs.

DOUBLE ENTRY

Here is your first lesson in double-entry bookkeeping. We shall not, at this stage, open up separate accounts for this second entry. The keeping of the ledger will be the subject of our next article. It is sufficient up to this point to grasp the fundamental rule: "Debit whatever is received; credit whatever is given up."

Now write down the expenses incurred in earning the income for the month. Firstly we have purchases of £100. Not all these, however, were sold again. You count up your stock and find that you still have £50 worth

(Continued on Page 95)

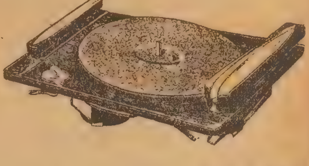
MAKE YOUR OWN RECORDS

Of Radio, Music, Speech, Orchestral and Vocal Items

Make your own records with the American "Green Flyer" Recording Unit — uses standard 10" discs. Suitable for recording radio programmes, speech, vocal and orchestral music. For full particulars write for technical data sheet.

Recording and play back unit as illustrated	£25/-/-
4 valve amplifier with matching transformer	£20/10/-
Carrying Case (leatherette covered)	£5/-/-
Microphone	£8/2/6

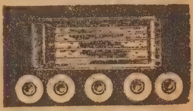
These units can be supplied mounted with speaker, recorder and amplifier as a self-contained unit at £59/10/-. Recordings may be made and played back independent of any other equipment.



£29/10/- BUYS THIS 7-VALVE DUAL WAVE RADIO

INCLUDING MAGIC EYE TUNING

This ready wired and tested radio chassis is complete with valves and 12" speaker, and is especially designed for the reception of overseas stations. Ultra modern circuit incorporates iron cored coils and I.F. transformers, automatic volume control, latest valves: 6SK7, X61M, 6AR7, 6SJ7, 6V6, 5Y3GT, 6U5; large modern edge lit straight line tuning dial, four controls: volume control, station dial, tone control, wave change switch: provision for phonograph pick-up connections. Overall size of chassis 16" x 10" x 9½" high. Price, £29/10/-, complete, less cabinet, plus freight. Mantel model cabinet to suit, leatherette covered size approximately 21" x 13" x 13" high, £4/17/6.



240 VOLT A.C. AUTOMATIC RECORD CHANGER

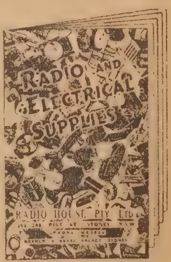
Reduced from £18/10/- to £10/17/6

It's a Special Purchase — but hurry before they go!

The Plessey British-made record changer is second to none. Special features are: repeat and reject buttons, automatic cut-off after playing last record—will take eight records, either 10" or 12", grouped or intermixed. This unit is also available as a portable phonograph complete with 4 valve amplifier and 8" speaker mounted in a leatherette covered carrying case. Being self-contained, it can be plugged into any 240 volt A.C. power socket and used independent of radio; suitable for use with a microphone, size 17" x 17½" x 9" high, £28/17/6, plus freight.

THIS MONTH'S SPECIALS

"F.W," English permagnetic speakers, 6", 16/6. 8", 19/6, complete with 5000 ohm transformer. Posted 2/- extra. These are ideal for an extension speaker.
"Marmac" centre drive phonograph motor, 78 R.P.M., and speed control. 12" turntable, £4/-/-, plus postage.
Swivel head torch, all chrome finish, 2 cell, standard batteries complete. 19/6 posted. Spare globes, 7d each.
"Philips" neon pocket screwdriver and tester, 110-750 volts; for electrical work, 7/6 each, plus postage.
"B. & W." spark plug, neon ignition screwdriver and tester, 7/6, plus postage.
"Red Spot" semi fixed permanent crystal detector, 9/6 each, 10/- posted. 6 volt battery operated fan, suitable for cars. 4" blades, 45/-.



Owing to the heavy demand for the 80-page Radio and Electrical Catalogue, our supplies have been depleted, and we will not be able to fufill the many requests for a copy until further supplies of a revised and up-to-the-minute issue are available from the printers. If you would like a copy of this complete guide to radio and electrical parts with a free resistor color code, write to the address below, and one will be forwarded as soon as possible. If you have already written, yours will be sent as soon as supplies are received. Either write or cut out coupon below.

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A COURSE IN TELEVISION

A complete article, in the July issue last, was given to an explanation of the DC component in a television signal. Where it cannot be preserved, it must be re-created artificially immediately before the picture tube grid. This article examines the process of DC restoration.

Part 17—DC RESTORER CIRCUITS

READERS would be well advised, before going further, to scan back through Part 14 of this series, which was intended to serve as an introduction to this present article.

It is sufficient to reiterate here that a television signal is not, at any stage, fundamentally balanced like a sound signal. The carrier amplitude rises and falls abruptly according to the light and shade of the picture. The resultant rectified video signal is a voltage varying continuously in relation to the black or white level, according to the method of transmission.

VARYING DC

The proportional voltage difference between the instantaneous signal and the black or white reference level must be maintained at all times in order that the picture shall appear generally bright or generally dark, according to the nature of the scene.

Electrically, therefore, the video signal must be treated as a varying DC potential or, what is essentially the same thing, as a DC potential with a super-imposed and a highly irregular a-c wave-form. Ideally, both should be preserved or amplified and both applied to the grid of the picture tube.

In practice, the DC and AC components are present in the output of the video detector and no difficulty ensues where this output can be directly coupled to the picture tube grid. However, there are plenty of cases where it is desired to interpose video amplifier stages and, for electrical convenience, these almost invariably use resistance/capacitance coupling.

While the AC component can be very faithfully amplified by this method, the DC component is immediately lost and a restorer circuit must be provided.

Perhaps the simplest way of visualising the loss and subsequent restoration of a DC component is by considering a train of square wave pulses generated by nothing more ambitious than a battery and a rapidly moving switch.

In figure 1a, we have shown a 9-volt battery, a switch and a load resistor "R," across which the ultimate signal voltage is assumed to be built up. At the instant the switch moves upward, a potential of plus 9 volts appears across the resistor. It disappears immediately the switch reverses, producing a square wave train, as indicated by the accompanying diagram.

Now let a coupling condenser "C" be inserted in the circuit (fig. 1B) and the whole position changes.

At the first closing of the contacts, the full 9-volt pulse is applied through C on to resistor R and we have the condition represented at point 1. However, the switch contacts remain closed for a finite period, leaving the circuit in a static condition but with a potential across R. A current naturally tends to flow through the resistor and it may, for example, reduce the potential across the resistor to say 8 volts at point 2 on the graph.

REVERSE CONNECTION

At this juncture, the switch reverses its connection, suddenly reducing the potential on the left-hand side of the condenser by 9 volts. This carries the voltage across R to point 3, which is negative with respect to earth.

A further and reversed discharge period follows to point 4 but it does not cancel the original discharge before a further positive-going pulse is received. This may carry the potential across the resistor to say $8\frac{1}{2}$ volts positive, which discharges to $7\frac{1}{2}$ volts before the return pulse is applied.

The process continues until the total shaded area below the refer-

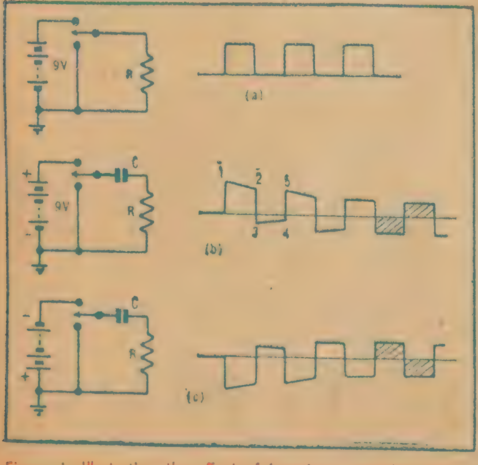


Figure 1. Illustrating the effect of inserting a coupling condenser into a circuit. Note that the DC component is lost.

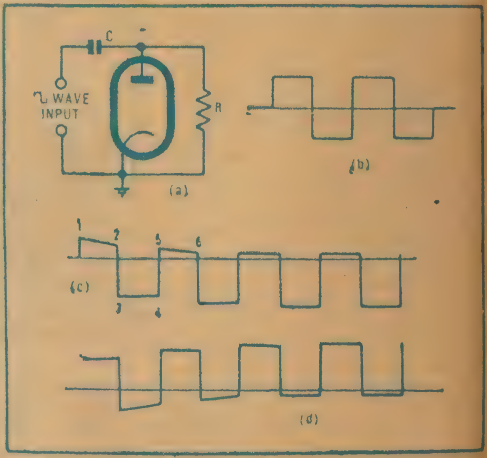


Figure 2. The action of a DC restorer (a) in passing the wave train (b), produces (c) which has a d-c component. Reversing the diode polarity produces the positive effect (d)

ence line is equal to the total shaded area above the reference line. The number of cycles needed to reach this state depends on the constants of the circuit but the condition of balance will ultimately be arrived at.

When this happens, the DC component has obviously been lost, even though the shape of the wave may be closely preserved.

It is interesting to note that a wave produced by a negative-going pulse will ultimately resolve into the same form, as indicated by figure 1C.

Furthermore, while regular waveforms have been assumed for the sake of illustration, the same averaging process goes on with the highly irregular waveforms characterising a television signal.

SIMPLEST FORM

The simplest form of d-c restorer is provided by the humble diode detector and its action is illustrated by figure 2.

Imagine that a square wave is fed into the circuit of figure 2a. Keeping to the purely hypothetical values already suggested, the first positive-going pulse amounting to say 4½ volts would be applied through the condenser C to the plate of the diode and the top end of resistor R.

Since the plate would then be positive, the diode would immediately commence to conduct, causing a flow of current through R and making the top of R much less positive than at the beginning of the pulse. In other words, the diode would rapidly create a potential difference across C between the points 1 and 2 on the graph.

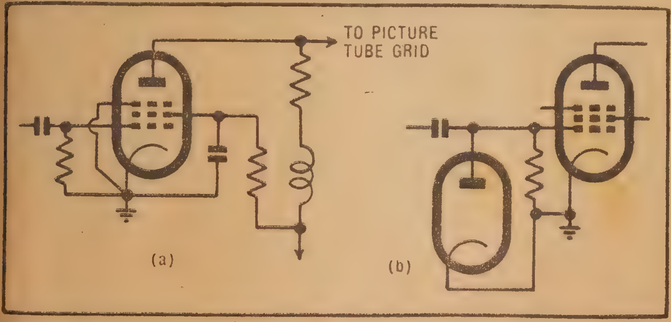


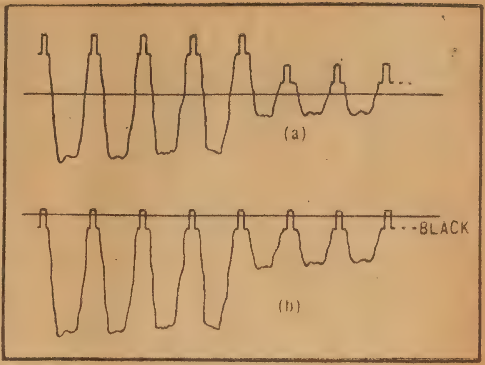
Figure 4. Operating without grid bias, a final video amplifier can provide its own DC restoration. There are complications, however, as outlined in the text.

COUNTER DISCHARGE

At point 2, the 9-volt negative going pulse would carry the potential at the top end of R to a point which might be 6 volts negative. Between points 3 and 4 there would be a slow counter discharge of condencer C through resistor R only.

However, a further rapid discharge period occurs between points 5 and 6 with the diode conducting. After a few cycles, the top of the wave tends to level off at a potential close to the reference line, the bottom of the waveform being projected into the negative region.

Figure 3. Minus its DC component, a video signal may appear as figure 3a. When passed through a negative d-c restorer the effect is as illustrated in (b).



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The condition of stability is reached where the amount of charge through the diode on the positive half cycles is just equal to the charge lost through R during the rest period on the negative peaks.

Figure 2d shows the reverse condition where the diode is connected the other way round in the circuit. Here the waveform is lifted in a positive direction so that it resembles the original waveform introduced in figure 1a.

Connected as in figure 2a, the diode is said to act as a "negative" d-c restorer, while figure 2b is a "positive" restorer.

Once again the general statement can be made that a restorer operates in the same fashion on irregular waveforms, tending to line up the positive or the negative peaks, according to its connection in the circuit. The action is analogious to that of an ordinary A.M. detector.

The actual connection into the video circuit depends both on the nature of the transmission and the polarity of application to the picture tube. As mentioned in an earlier article, the signal may be applied to the intensity grid, if required and the cathode made "earthy." In this case, a positive-going pulse is required to produce a highlight. Alternatively, the signal can be applied to the cathode and the grid held to earth potential for video frequencies and, in this case, a negative going pulse will produce a highlight.

To take a specific example, figure 3a might represent the output from the final video amplifier . . . the synchronising pulses being intended to extend into the "blacker than black" region of the picture tube characteristic.

If it is assumed that the pulses pointing upwards are positive-going then the signal would obviously have to be fed to the cathode for the positive-going pulse to reduce the light spot intensity.

"BLACK" LEVEL

However, it is equally obvious that the "black" level is wandering up and down due to the absence of the d-c component, with the result that no amount of juggling would keep the timing pulses level or out of the normal grey to black response.

Negative d-c restoration, as in figure 2a, is needed to line up the tips of the timing pulses. This would produce the result illustrated in figure 3b in which the positive tips are lined up or "clamped" and the signal representing the white peaks is negative going with respect to the reference line.

This is exactly what is required, the negative pulses on the cathode tending to produce highlights in the picture. Obviously, a pulse which tends to send the cathode negative with respect to grid has the same effect on beam current as one which tends to send the grid positive with respect to cathode.

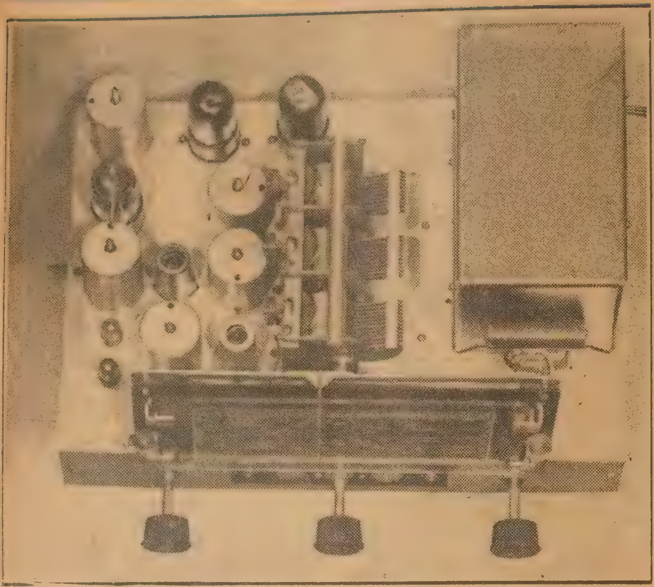
FEEDING A SIGNAL

It may be observed, in passing, that there is no special problem about feeding the signal to the cathode of a picture tube. The beam current is normally so small that degenerative and loading effects are not a problem, as they are in the cathode feed to conventional amplifier valves.

The foregoing will serve to illustrate the action of a restorer circuit but all kinds of variants are possible.

Capacitance coupling can be maintained right up to the picture tube input and the diode connected in the appropriate phase to line up the black level and pulses. Alternatively, the diode may be connected in the

(Continued on Page 98)



In this plan view the 6BA6 is in the centre front with the aerial coil to the left and the RF and oscillator coils in line toward the rear. The 6BE6 is behind the aerial coil and is followed around the chassis by the IFT 1, 6SK7-GT, IFT 2, 6SJ7-GT and 6V6-GT. The controls are from the left: Volume Tuning, On/Off and Voltage Control Switch.

VIBRATOR SET FOR 32 VOLTS

Here is our second bid to most the ever-present demand for 32-volt equipment. Using only five valves, this set brings to the country listener all the gain and power available for a mains operated receiver. The filaments and vibrator supply together draw less than a couple of ordinary light globes.

by Raymond Howe

READERS will doubtless remember the 32 volt receiver which was described in the January, 1950 issue. This has proved to be a very successful design and we have received a number of glowing reports of its performance from readers who have built it.

In that particular set, the 32 volt supply constituted the sole HT voltage for the plate and screens of the valves and, as a result, it was necessary to use more valves than would have been the case with a set operated from a much higher voltage. However, even with push-pull audio output, the available power for the speaker was restricted to a figure of around the 200 mW mark, because of the use of the restricted HT voltage.

MORE AUDIO

Of course, these remarks are not intended to suggest that 200mW is just a whisper. An audio level of this order, heard on an efficient and well-baffled speaker, is generally adequate for a quiet country home. Nevertheless, there are cases when more audio power is required and the only practicable way to get around the point is to step up the volts on the plates and screens of the output stage.

In this set described here, we have adopted just that approach by redesigning the set completely to incorporate a vibrator supply operated from the 32 volt to enable the valves to function with something approaching their normal voltage. This result is increased gain and more audio power with a reduced valve complement.

Unfortunately, the provision of a power supply and dropping resistors complicate the circuitry in other respects, but, after all, the set is merely coming into line with the regular 5/6 valve a-c operated style.

GENERAL DESIGN

The general design of a set such as this, is fixed to a large extent by the rating of available vibrator transformers and cartridges. A transformer having a 250 volt 60 mA. secondary rating appeared to be the logical choice, bearing in mind that what comes out of this secondary, governs the current through the vibrator primary contacts and there's a limit to the cartridge primary contact current.

So we are fixed with about 60 mA of HT current drain and quite a lot to be done with it. Some early thoughts pondered on the idea of letting the output stage run "flat out" on the vibrator supply with the remaining stages functioning from the straight 32 volts. Other ideas were to let the output stage run close to its maximum drain and then keep the total drain within the limits by running the screens of the first three valves well down.

However, we finally settled for the present set-up, which has the converter and the IF valves under normal conditions, the high-slope RF valve cut back slightly and the audio output stage biased back a little further. The result is a sensitivity figure in microvolts which can be counted on the fingers of one hand and an audio power in watts which can be counted on the other.

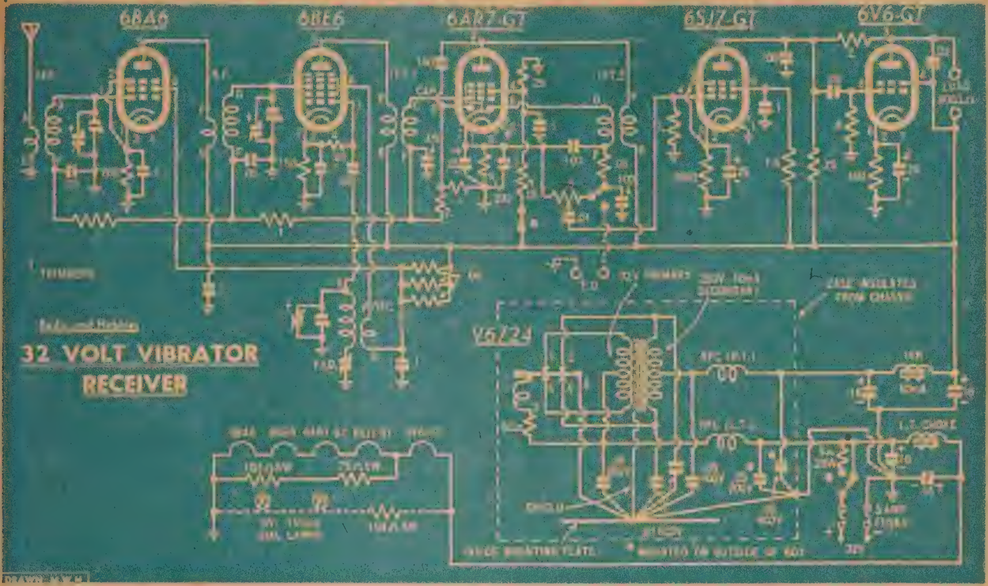
FRONT END

The front end of the set remains much the same as in the earlier 32 volt set, apart from coping with the higher voltage, and applying AVC to the converter as well as the RF and IF stages.

The 6BA6 is retained in the RF stage and it is quite a logical choice because of its high GM and variable-mu characteristic. Much the same remarks apply to the use of the 6BE6 converter valve. Its conversion transconductance is high, as is the oscillator transconductance.

This latter point can, however, be a little embarrassing as far as the oscillator coil is concerned. Because of the high oscillator GM, a

CIRCUIT DIAGRAM FOR 32-VOLT VIBRATOR SET



The circuit diagram is very effective and yet not unduly complicated. There should be no difficulty in suppressing vibrator interference if the filtering procedure mentioned in the text is adopted. The attachment of a good earth lead to the set chassis may help in removing the last vestige of interference.

lower feedback voltage is required into the oscillator grid circuit than in other lower gain valves and, consequently, an oscillator coil especially designed for the 6BE6 is recommended. If you are unable to procure one, a standard oscillator coil could be used if a resistor of about 1500 ohms is shunted across the feedback winding. The general result is much the same.

While on the matter of oscillator coils, an interesting point arises. All standard oscillator coils are slug-tuned and, in all cases, the necessary oscillator alignment adjustment at the low frequency end of the tuning range can be made with the oscillator coil slug in conjunction with a fixed padder capacitor of appropriate value.

OSCILLATOR COIL

However, one coil manufacturer prefers to set the oscillator coil inductance at the factory, seal the slug and recommend the use of a variable padder capacitor. This approach is intended to overcome possible difficulties when there is wide discrepancy between the actual and marked values of a fixed padder capacitance. Such recommendation is marked on the can, so we will leave it to you.

The remaining point of comment on the RF and converter stages is that the RF screen and the oscillator HT are obtained through a common dropping resistor. As the screen of the 6BE6 acts as the oscillator section anode, it is taken care of at the same time.

The IF stage carries a 6AR7-GT valve with the diode plates employed for detection and AVC. This valve is a convenient type for this stage although an EBF35 could be used if desired. The socket wiring differs slightly, of course. Control voltage from the AVC diode load resistor is fed to the RF, converter and IF valves and provides good automatic control of the volume.

We have shown dotted in the circuit diagram the necessary alterations to the wiring of this stage to enable a "radio/pickup" switch to be incorporated if your ideas run in that direction. Note that in addition to switching the volume control between the diode circuit and the "hot" pickup terminal, the screen voltage feed to the 6AR7-GT is open-circuited when switched to the "pickup" position. This is to avoid radio programme filtering through to the

PARTS LIST

1 Chassis 12" x 9" x 2½".
1 Vibrator case 6" x 5" x 3⅝" with inside mounting plate.
1 Vibrator power transformer, 32v primary, 250v 60 mA secondary.
1 24 volt vibrator cartridge, type V6724.
1 HT filter choke, 15 henry 60mA. 1 LT iron-cored filter choke.
1 LT RF choke, 1 standard RF choke.
1 3-section tuning gang capacitor (AWA or Stromberg H), 1 dial with glass to suit (USL/32A or similar).
1 Broadcast aerial coil, RF coil and oscillator coil (for 6BE6).
2 455 kc standard IF transformers, Nos. 1 and 2.
2 5 amp fuse holders, 1 3 x 3 single gang wafer switch.
3 Octal sockets, 2 7-pin miniature button-based sockets, 1 4-pin socket, 1 6-pin socket.
1 Variable padding capacitor for 455kc, 3 gang trimming capacitors, 2 dial globes, 6-8 volt 150mA.

CONDENSERS

4 16 mfd 525PV electrolytic capacitors, 3 25 mfd 40PV electrolytics, 2 0.25 mfd 200VW, 4 0.1 mfd 400VW tubular, 3 0.1 mfd 200VW, 3 0.05 mfd 400VW, 3 0.05 200VW, 1 0.02 mfd 400VW, 3 0.01 mfd 600VW, 4 100 pf mica, 1 50 pf mica.

RESISTORS

2 2 meg. 1 1.5 meg, 2 1 meg, 1 0.5 meg, 1 0.5 meg potentiometer, 2 0.5 meg, 2 0.1 meg, 2 0.05 meg, 3 0.04 meg, 1W, 1 2000 ohm, 1 400 ohm wirewound, 1 300 ohm, 1 200 ohm. 1 150 ohm, 1 150 ohm 5W, 1 100 ohm 5W, 1 75 ohm 5W, 1 50 ohm wirewound, 1 5 ohm 20W.

SUNDRIES

3 Knobs, 4 3-tag mounting strips, 1 4-tag mounting strip, 1 doz small rubber grommets, 1 rubber grommet for power flex, suitable length of 2-core flex, with plug, 2ft shielded hook-up wire, 2 terminals (1 red, 1 black) 4 2" x ⅛" bolts, hook-up wire, spaghetti, nuts and bolts, solder lugs, solder.

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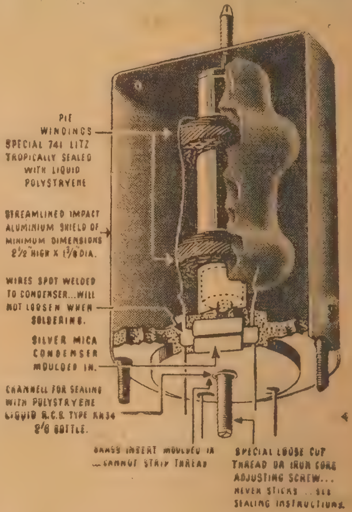
Cross section of R.C.S. intermediate transformer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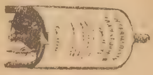
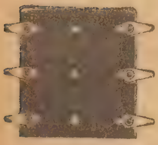

R.F. transformer

Radio frequency choke.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audio section when using the pickup.

A suitable switch is a double-pole-double-throw toggle which can be mounted on the rear face of the chassis near the pickup terminals. Incidentally, if you happen to be using a magnetic type of pickup, clip a resistor of about 0.5 megohms across the terminals.

The audio end of the set is more or less standard and quite straightforward. It consists of a 6SJ7-GT audio voltage amplifier stage, resistance-capacitance coupled to the 6V6-GT power output pentode with an optimum amount of negative feedback between the stages. The current drain of the 6V6-GT is kept down by increasing the value of the cathode bias resistor over the nominal 250 ohms.

No variable tone control is fitted to the audio section, a fixed degree of treble attenuation afforded by the 0.02mfd between plate and screen of the 6V6-GT being considered adequate. This allows the number of controls to be kept to three the third one being the on/off and voltage control switch. The other two are, of course, the tuning and volume.

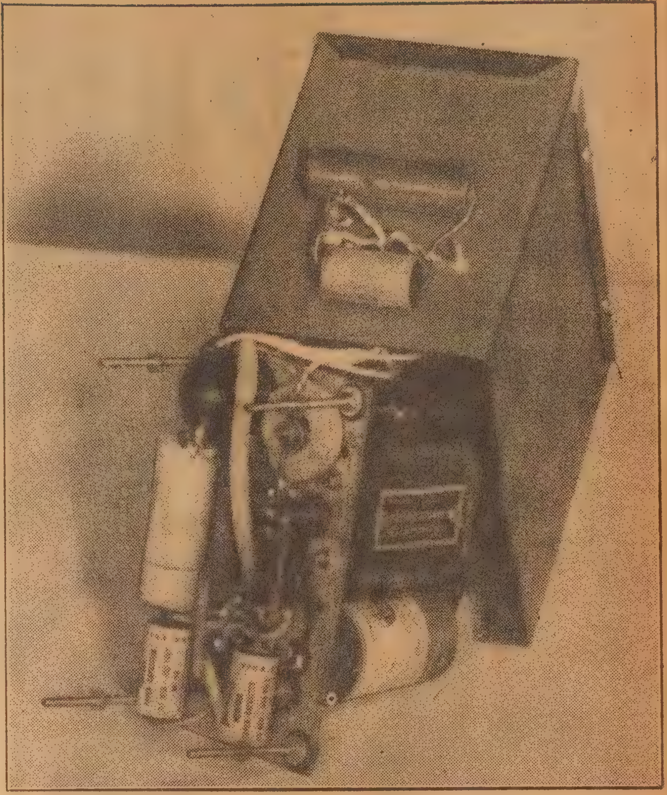
Coming now to the voltage supply to the set, let's start from the 32 volt input point. You will see that 5-amp fuses are provided from the point of view of safety and convenience. They are not absolutely necessary and we will consider them an optional fitment.

VOLTAGE SWITCH

The voltage switch forms a ready means of controlling the voltage to the set when the line voltage is high, such as during battery-charging periods or under very light load on a fully-charged battery bank. In one position, full line volts are applied to the set whilst in another position a series dropping resistor is brought into circuit to keep the volts input to the set within a reasonable plus or minus range of 32 volts. Quite logically, the third position of this switch is arranged to switch off the supply to the set. We used a 3-pole, 3-position wafer switch for the job with two sections wired in parallel. You can wire the three sections in parallel, if you wish.

As you can see from the circuit diagram, the heaters of all of the valves are wired in a simple series circuit with a resistive branch shunting the first four. The current through the entire circuit is 0.45 ampere with 0.15 passing through the resistive branch. The inclusion of dial lamps across the supply is optional and consequently is merely shown dotted in the circuit.

The entire filtering of the heater circuit consists of a low tension type iron-cored filter choke with 16mfd electrolytic capacitors fore and aft. While the 16mfd size will do a very good job, use 24mfd electrolytics if you can obtain them. Incidentally, don't use the 25mfd 40 peak volt type of electrolytics for this part of the circuit as they may not take the fluctuations of the 32 volt supply too kindly.



The vibrator case with the innards exposed. The top of the mounting plate carries the transformer and vibrator cartridge, all wiring and other components being on the underside. The common earth point is near the vibrator socket. Note the four long bolts mentioned in the text.

H.T. SOURCE

The matter of providing the HT source for this set raises some interesting points. If 32 volt vibrator cartridges were available, it would merely be a matter of mating one of that type with a 32 volt vibrator transformer. However, to the best of our knowledge, the highest voltage for which cartridges are at present available is 24 volts. The matter more or less hinges on this point.

Various manufacturers adopt different approaches to the problem and which range from using a 24 volt cartridge with a 24 volt transformer to a 12 volt cartridge with a 12 volt transformer, with a common dropping resistor employed to keep the two components operating within their limits.

However, with vibrator cartridges which have a separate driving contact, it is simply necessary to provide the driving coil with the required voltage or, conversely, driving current, while the primary contacts can handle whatever voltage is convenient and which is in keeping with the primary winding voltage of the transformer selected.

In the interests of transformer efficiency, it would be logical to use a high voltage one and for this reason we have adopted the 32 volt primary type. A local transformer manufacturer has assured us that there is no likelihood of such transformers breaking down if the primary supply rises somewhat above the nominal 32 volt figure.

This transformer is used with a 24 volt vibrator cartridge having a separate driving coil which is excited from the 32 volt source through a series dropping resistor. This resistor is of such value that the voltage across the coil is sufficient to cause immediate starting of the reed.

The optimum value of this resistor is dependent upon a couple of factors and hence is open to variation. A lot depends upon the regulation of the supply from the battery bank and the actual voltage available in the house for the set after allowing for line drop under average load. Further, there will possibly be some variation in the voltage at which vibrator reeds will start.

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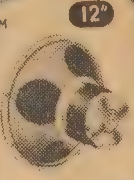

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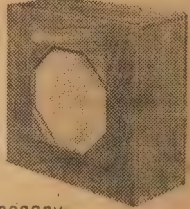
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SERIES RESISTOR

Adding all of these points together, we suggest that you try a 100 ohm resistor in series with the driving coil of the vibrator cartridge and if you find that it will start consistently without any fuss or bother when your average household load is on the 32 volt supply line, then leave it in. If, on the other hand, there is some indication of sluggishness, then drop to a 75 or a 50 ohm value for the resistor. The main point is to bear in mind a figure of about 28 volts as the maximum voltage allowable across the driving coil.

So much then for the major components of the HT supply. The associated minor components follow normal design practice, although the actual location of them will be dealt with very shortly.

The two 0.01 mfd 600VW capacitors connected across each half of the transformer secondary winding are the buffer capacitors and should be of a value recommended by the transformer manufacturer. The value of 0.005mfd was recommended for the particular brand of transformer used in this set and this value is obtained by connecting two 0.01mfd in series across the winding. By obtaining the value in this way and using 600VW type, there is little likelihood of them breaking down.

The low frequency filtering of the HT output is achieved by the use of a 60mA filter choke having a reasonable value of inductance in conjunction with two 16mfd 525PV electrolytics. If you can obtain 24mfd 525PV electrolytics, so much the better, although with the 16mfd the hum was barely perceptible. In selecting the choke, choose one having a reasonably low value of DC resistance in order to avoid too much voltage drop across it. A figure of 300 odd ohms would be about nominal for a suitable choke.

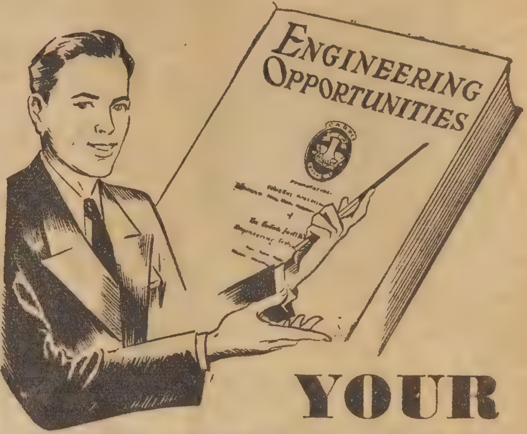
CONSTRUCTIONAL

Coming to the constructional side of the story, we will deal first with the vibrator supply. Although we have covered many times the important basic details of such supplies used in other sets, they cannot be repeated too often if the desire is to drag interference from the vibrator cartridge down to an absolute minimum.

The first step in making the task of duplicating results a little easier is to budget for a completely enclosed and self-contained power unit. Suitable cases complete with internal mounting plate for the components are available at many of the radio supply houses.

Mount the transformer and the vibrator socket in the manner illustrated in the photograph, using rubber grommets to shock-mount the socket. It may be necessary to drill a few holes in this base plate to take the particular transformer and to pass the leads through. The photograph gives all other details of component mounting.

Four long bolts secure the mounting plate to the bottom cover of the case and, finally, the whole case to the set chassis. The bolts are insulated from the metal in each case



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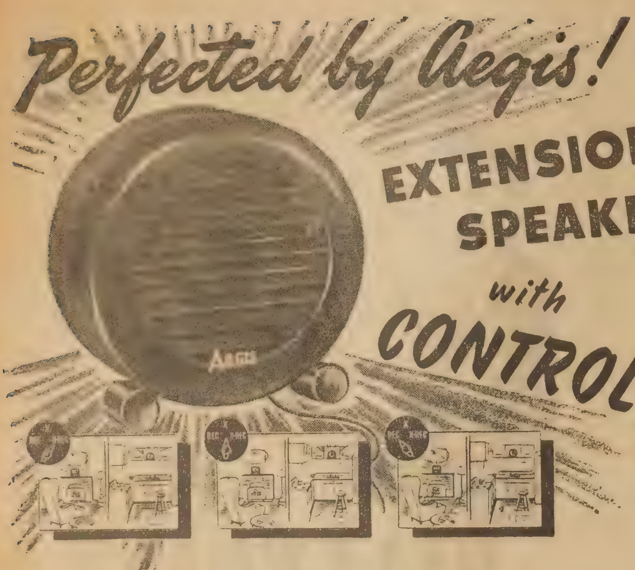

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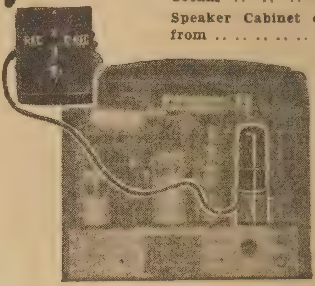

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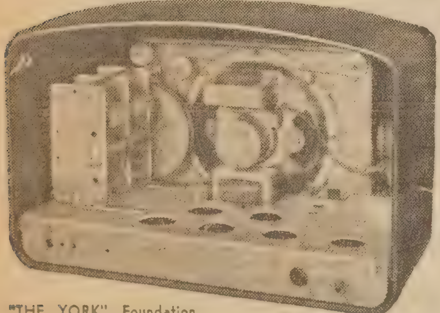

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with the aid of small rubber grommets. This arrangement means that both the mounting plate and the case are "floating" and available for single-point earthing technique.

EARTHING

To follow this technique through, make all "earth" connections in the wiring to one common point only on the mounting plate. This common "earth" point is then connected by a piece of braid to a point on the outside of the case just near the hole through which the leads are taken. Slip some spaghetti over the braid. This "earth" point on the case is connected to the common "earth" point on the set chassis.

Three leads leave the case, one is the earth lead just mentioned, while the other two carry low tension and high tension respectively. These two leads are bypassed at their point of exit from the case. These two bypass capacitors are mounted on the outside of the case and are earthed to the same point as that to which the earth lead is connected.

By following this technique, all RF filtering and bypassing is confined within the shield case and the two outgoing supply leads are, from the point of view of RF, at much the same potential as the case.

The set was constructed on the same chassis as was used for the 32 volt Receiver of the January, 1950 issue. The three unused holes toward the right rear of the chassis are covered with a plate, as is the 1¼-inch hole on the bottom cover of the vibrator case. Very few extra holes are required, there being four for the mounting of the vibrator supply, two each for the two chokes and one for the three-tag mounting strip which holds the run of shielded hook-up from the volume control to the wiring around the diode and first audio circuitry. Remember, that the four holes in the chassis for the vibrator case mounting need to be enlarged to take small rubber grommets or some form of insulating washers.

EARTH WIRE

In preparing for the wiring, place solder lugs under most of the component and valve socket securing bolts and run a length of tinned copper around to these lugs so that all earth points are tied together. This little act can save one or two headaches later, if a poor earth point prevents the set from functioning.

As the layout is arranged, the supply wiring and filtering components are to one side of the chassis, while the wiring of the set proper is toward the other side. This minimises introduction of any interference into high impedance grid circuits through unwanted capacitance coupling.

Don't forget to earth the shield pin of the 6AR7-GT and the 6SJ7-GT. The centre spigot of the sockets for the 6BA6 and 6BE6 should also be tied to earth. Try to make all earth connections for each stage to one or possibly two points close to the particular socket.

(Continued on Page 102.)

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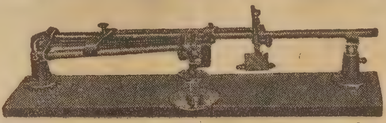

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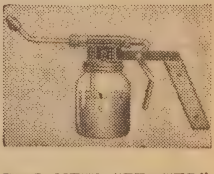

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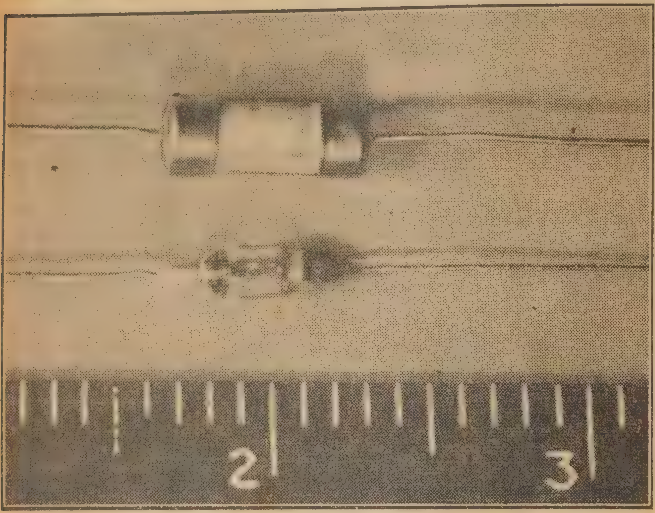
APPLICATIONS OF CRYSTAL DIODES

For the first time, crystal diodes are available cheaply and in good supply on the local market. This article describes their general characteristics and how they may be used in all kinds of devices ranging from a simple crystal set to a C.W. modulator.



A Sylvania 1N34 at the top and the British equivalent type compared with a standard rule. The diodes are approximately twice normal size.

THERE is nothing specially mysterious or new about crystal diodes. Despite color codes and type numbers, they are simply a logical development from the catswhisker device which every beginner has played with for the last 25 or 30 years.

With the introduction of valves, the crystal was relegated to a very minor place in the scheme of things and there it might have remained but for wartime investigations into radar and associated U.H.F. problems.

OPERATION ON UHF

Without going too far into the matter, it was obvious that operation would be required at frequencies where the then-known valves were next to useless, because of lead inductance and transit time losses.

While some workers turned their attention to producing radically new valves, others went right back to the simple crystal rectifier as a possible "first detector" in microwave receivers. They reasoned that, if it could be made small and stable, it would operate as a frequency changer to produce an intermediate frequency capable of being handled by ordinary valves.

The idea of using a crystal detector as a frequency changer or mixer may be new to many readers but it is, in fact, a completely feasible scheme. Such a detector, like the ordinary thermionic diode, has a non-linear resistance characteristic and, provided it is fed with an oscillator injection voltage of sufficient magnitude, it can be made to change an incoming signal to an "intermediate" frequency, according to the accepted superhet idea.

To be sure, there can be no conversion gain, because a simple crystal cannot amplify. However, a low-gain, low-noise mixer is better than none at all and the gain can be made up in the I.F. channel.

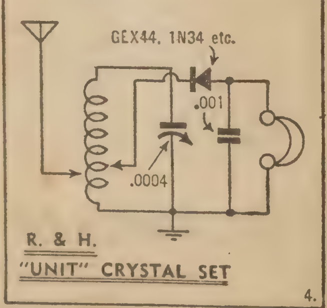


Figure 4: Germanium diodes like the 1N34, the GEX33 or the GEX44 perform extremely well in a crystal set.

The essential circuit of a microwave frequency changing stage is indicated in figure 1, for those who may be interested.

The oscillator may not be a simple valve circuit of course. Where the required injection frequency is very high, a second crystal may be used to accentuate a certain high order harmonic, which is then injected into the mixer, to produce the intermediate frequency.

The possibilities of an improved crystal rectifier extend, of course, well beyond these suggested applications. It has an obvious application for detection, AVC, noise limiting etc., as well as in valve voltmeters, field strength meters and a variety of other devices which had been built around thermionic rectifiers. The "comeback" was inevitable.

USE OF CRYSTALS

Investigation showed that two metals in particular possessed the necessary non-linear characteristics, namely silicon and germanium. As might be imagined, there is quite a story behind the chemical structure of each and the impurities which are deliberately introduced to increase the rectification efficiency. Without going into this either, it is sufficient to record that crystal diodes can be classified generally as "silicon" or "germanium" types.

As a general rule, the silicon types are used for superhet mixer and oscillator applications and some of them carry frequency ratings up to about 30,000 megacycles. The germanium types, on the other hand, are favored for general detector, rectifier and instrument application and carry a frequency rating of up to 100 odd megacycles.

The method of assembly varies with the manufacture but figure 2 shows the structure of the early diodes developed in America by the Sylvania Company. To date, these have been the best known and the most widely used.

SILICON DIODE

Figure 2a shows the type 1N21B silicon diode, which rather resembles a small bullet in appearance.

A fragment of special silicon crystal is soldered to an adjustable pillar, which screws up inside a gold-plated base contact.

Bearing against the face of the crystal is a "whisker" of tungsten or similar material, which is soldered into a second gold-plated pin contact.

The whisker is set to bear on a sensitive spot on the crystal surface and the unit is then filled and sealed via the filling hole.

The treatment of the germanium diode is simpler, the finished product having the appearance of a small resistor.

Once the "whisker" is properly located on the surface, it is cemented or fused into position, so that the unit is then impervious to shock or vibration. It is simply installed in the wiring and will apparently retain its characteristics indefinitely.

In the Sylvania range, the 1N21B is recommended for operation at up to 3000Mc. The 1N23B is available for operation up to 10,000Mc, while the 1N26 carries on to about 25,000 Mc.

In all these types, the capacitance between the elements is from 1 to 3 picrofarads and the natural resonance of the structure extremely high. They can be used with both sides above earth but they must be protected against high signal voltages or currents which tend to burn the whisker-to-element junction.

GERMANIUM DIODES

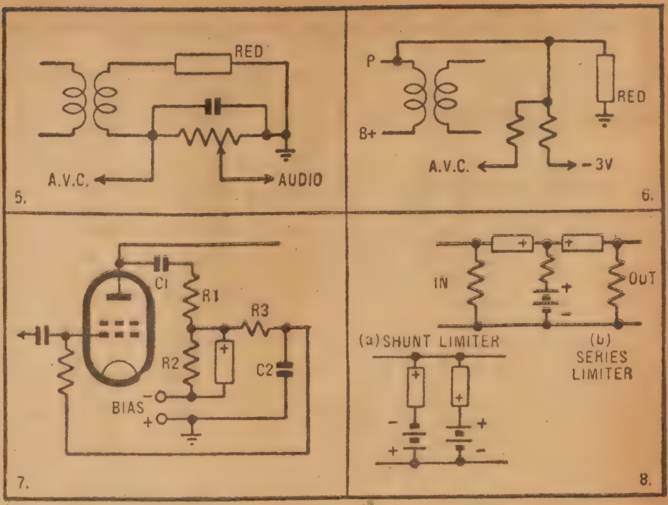
Generally speaking, germanium diodes are the types most interesting to experimenters and enthusiasts, since their frequency rating is ample for most purposes and they are less easily damaged by electrical overload.

A relatively small number of crystal diodes have come into experimenters hands, mainly from disposals sources, but dollar restrictions have hitherto prevented their importation on a large scale.

However, a local valve company is now making available a line of germanium diodes imported from Britain and retailing for as low as 8/- each. At this figure they are an attractive proposition for experimenters and a variety of applications will suggest themselves.

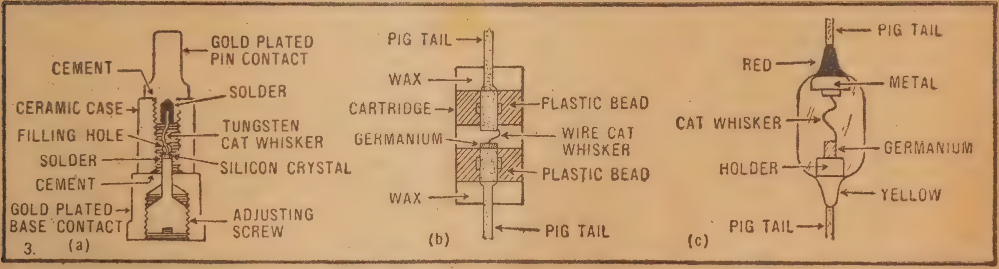
Full details of the diodes are not available at the time of writing but a booklet containing application data is in course of preparation by the manufacturers.

They state, however, that their type GEX44 is a near-equivalent to the American 1N34, as far as electrical characteristics are concerned. It is classified as "a rectifier suitable for feeding medium impedance circuits, such as second detector in broadcast receivers, in narrow band amplifiers, as a limiter in FM circuits, or as a discriminator-rectifier.



RED
A.V.C.
AUDIO
5.
P
B+
RED
A.V.C.
-3V
6.
C1
R1
R3
R2
C2
BIAS
7.
IN
OUT
(a) SHUNT LIMITER
(b) SERIES LIMITER
8.

Figures 5 - 8: Illustrating the application of crystal diodes as a detector (5), for delayed A.V.C. (6), as a battery economiser (7) and as a noise limiter (8).



GOLD PLATED PIN CONTACT
CEMENT
SOLDER
CERAMIC CASE
TUNGSTEN CAT WHISKER
FILLING HOLE
SOLDER
SILICON CRYSTAL
CEMENT
GOLD PLATED BASE CONTACT
ADJUSTING SCREW
3.
(a)
PIG TAIL
WAX
CARTRIDGE
PLASTIC BEAD
GERMANIUM
WIRE CAT WHISKER
PLASTIC BEAD
WAX
PIG TAIL
(b)
PIG TAIL
RED
METAL
CAT WHISKER
GERMANIUM
HOLDER
YELLOW
PIG TAIL
(c)

Figure 3: The construction of typical crystal diodes (a) a silicon diode (b) the Sylvania 1N34 and (c) the British GEX44.

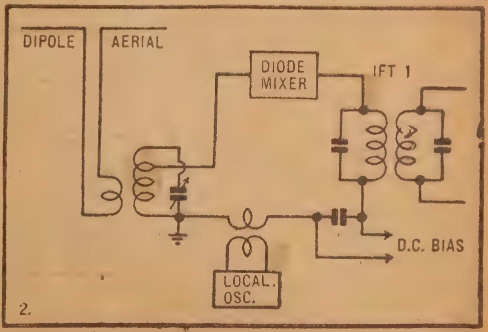
FORWARD CURRENT

As a measure of rectification efficiency, the forward current with 1 volt applied is greater than 1 milliamp, while the reverse current is less than 100 microamps with -10 volts applied. The negative turnover voltage exceeds 60, while the shunt capacitance is approximately 1 pF. —less than half that for the 1N34.

Physically, the GEX44 has the whisker and the germanium element sealed into opposite ends of a tiny glass tube, about 1/8" in diameter and just over ¼" long. Two pigtail connections allow it to be soldered directly into the circuit.

Type GEX33 has a designedly low impedance and is intended for use as a detector in wide-band equipment where a low value of detector load resistance is normally required. It is also useful as an instrument rectifier. The shunt capacitance is the same as for the GEX44 but both forward and reverse current reference figures are higher, as might be expected.

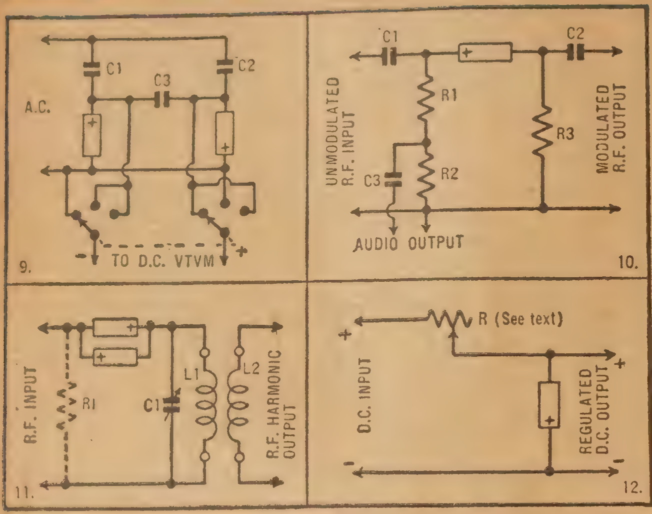
☆



DIPOLE
AERIAL
DIODE MIXER
IFT 1
D.C. BIAS
LOCAL OSC.
2.

Figure 2: Silicon diodes are commonly used as mixers in microwave superhet receivers.

The list mentions two other types which will probably be of less interest to experimenters. One is the GEX55, which is classified as a



Figures 9-12: Other suggested applications for germanium diodes. (9) a peak indicating VTVM probe (10) a tone modulator for generator or C.W. signals (11) a harmonic accentuator and (12) a voltage regulator.

high impedance rectifier, suitable for high impedance diode circuits or for use in a valve voltmeter probe. The GEX99 is described as being useful "as a general non-linear circuit element" operating as a current limiter, spark quench, channel switch etc.

The GEX series employ a color code system to identify both the type and the polarity.

All types have one end marked red. By inspection, this is revealed as the crystal and it corresponds to the cathode of a thermionic diode. When applied in a detector or rectifier circuit, it will be found that the end of the diode load connecting to this "red" pigtail will be more positive than the end connecting ultimately to the opposite side of the diode.

The remaining end of the diode is coded orange for the GEX33, yellow for the GEX44, green for the GEX55 and white for the GEX99.

From the experimenters point of view, the simplest application for one of the new diodes is in a crystal set.

By way of a test, we made a series of checks using the "Unit Crystal Set" described in the September 1948 issue and comparing results from a variety of detectors.

As originally described, the Unit crystal set employed a miniature copper-oxide detector, actually the WX-1 "Westector." This was found to give results at least equal to a good standard galena crystal and better than most.

However, installation of a crystal diode in the same receiver showed a distinct increase in signal strength and improved tonal quality, indicating a sharper "knee" in the rectification characteristic. In other words, there is every indication that the crystal diode is the best detector yet offered to crystal set fans.

Two distinct types were compared, namely the American 1N34 and the British GEX44, results being essentially the same. It is quite likely that GEX33, with a lower impedance characteristic will be better again and this point will be checked at the first opportunity.

POLARITY

For crystal set work, the polarity of connection into circuit does not matter. It works the same either way round.

Along other lines, an elementary form of "crystal" set can be used as a handy phone monitor in the "Ham" shack. The "coil" need be little more than a length of wire draped near the aerial feed and sufficiently close to pick up a few volts of signal for the detector and headphones.

Using a more complete circuit and a sensitive meter as well, it is possible to make a crystal receiver combining the functions of a field strength indicator and monitor.

A combined monitor and modulation indicator is yet another interesting possibility for the amateur who likes to invest in a couple of crystal diodes.

When used as a detector in a conventional superhet receiver, due note must be taken of the polarity, especially where AVC voltage is picked off for controlling the gain of preceding stages. It is also desirable to check the application data on available types to select the one having the most suitable impedance characteristic and an adequate peak voltage rating.

Figure 5 shows a typical circuit in which a crystal diode replaces an ordinary theormionic diode rectifier.

Figure 6 shows the connections for a conventional type of delayed AVC circuit. The delay voltage may be applied either as a standing negative bias at the diode load return or as a standing positive bias on the diode itself.

EXPERIMENTAL SCOPE

In addition to these obvious applications, overseas experimenters have devised a variety of novel and interesting circuit applications for crystal diodes and some of them are listed by way of interest. It is possible that more detailed information will be given on these and other circuits at a later date. How far they can be applied to types which will be available and how attractive they are in practice can only be established by actual experiment.

Figure 7 shows a possible "economiser" circuit for battery sets. It will be noted that part of the plate signal voltage is fed to a diode rectifier, the resultant d-c output affecting the grid bias circuit. The initial bias is made higher than normal to lower the standing plate and screen current.

A loud passage of signal causes the rectifier to set up an increased voltage across R2, tending to cancel some of the bias. The components R3 and C2 provide a suitable degree of filtering and time delay, but the reduced bias, which becomes effective at the grid, allows the valve to handle the loud passage to advantage.

Immediately afterwards, the bias rises to the standing figure and the plate current falls.

CONDENSER VALUES

The condensers can each have a value of about 0.1 mfd. while R2 may conveniently be .05 meg. R3 may be 0.25 meg., but the value of R1 depends entirely on the peak plate voltage developed by the valve chosen,

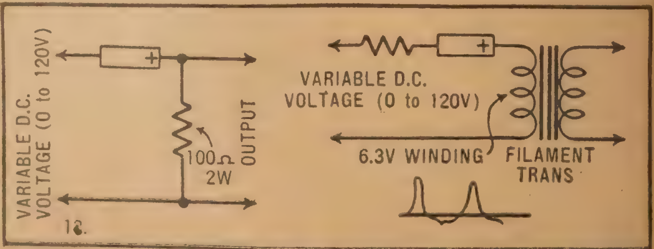

VARIABLE D.C. VOLTAGE (0 to 120V)
OUTPUT
100Ω 2W
13.
VARIABLE D.C. VOLTAGE (0 to 120V)
6.3V WINDING
FILAMENT TRANS

Figure 13: Using the diode as a relaxation oscillator. Other circuits have been devised giving a purer waveform.

the required degree of bias shift and the possible peak voltage limits on the diode. Generally it would be of the order of 0.1 to 0.25 meg.

Crystal diodes can be used in noise limiting circuits exactly as are valves like the 6H6 with the sole precaution that the voltage limits of the diodes are not exceeded.

In shunt limiters (8a) two diodes are connected across a high impedance circuit and in series with a delay voltage. The diodes do not normally conduct but, should the signal peak exceed the delay, the appropriate diode conducts, lowers the impedance of the circuit and tends to "short" the signal path.

SERIES CIRCUIT

With the series arrangement (8b) the diodes are normally conducting and handle both values of the input wave by reason of their phase opposing connection. Should a peak exceed the standing bias, however, the appropriate diode ceases to conduct and opens the circuit momentarily.

Limiting circuits in receivers can be used either in the audio channel or in the detector, where it is possible to obtain a degree of automatic adjustment, the diodes being "gated" by a bias depending on the carrier amplitude. This principle is used in all recent R & H communication receivers.

The limiting idea can be applied, obviously, to test equipment for the generation of square wave impulses. In all these applications the crystal diodes are used in exactly the same fashion as the 6H6, constants being adjusted where necessary to accommodate the lower peak voltage ratings of the crystal and likewise its lower internal impedance.

Figure 9 shows how two 1N34 type diodes may be connected for use in a valve voltmeter probe. It is so arranged that the d-c metering valve and circuit will read proportional to either a-c peak or to the total peak-to-peak amplitude.

A three-way switch, wired as shown, allows ready selection of the desired basis of reading.

Crystal diodes lend themselves particularly to this application because of the ease with which they can be connected into circuit. No heater wiring has to be considered, nor heater/cathode capacitance. A limitation exists, however, in that the applied peak voltage must not exceed 28 or 56 volts peak-to-peak. This rating applies for the 1N34 and something similar will probably apply to the British equivalent.

PEAK VOLTAGE

By way of contrast, it has been found possible to apply peak voltages amounting to several hundreds to thermionic diodes like the 6H6 and the EA50, without sign of breakdown.

The condenser values in figure 9 will depend mainly on the range of frequencies for which the probe is intended. For audio work, low voltage 0.5 mfd. units are suggested for C1 and C2, and a 0.25 mfd. unit for C3. Proportionally lower values will suffice for RF applications.

Another application, of especial interest to amateurs is a device for modulating a signal as it passes through the IF channel of a receiver.

A small oscillator, producing a 1000-cycle or other similar tone is installed in the receiver and the output impressed on the modulating circuit. All CW signals are therefore modulated and received as MCW signals.

Figure 10 shows a typical modulator circuit which can be connected between two back-to-back IF transformers in the IF channel.

Resistors R1 and R3 may be from 10,000 to 20,000 ohms each and R2 a few hundred ohms. The exact value, of course, will depend on the peak output from the modulating source.

FOR SIGNAL GENERATOR

The same type of circuit can be used to impress modulation on the output of a signal generator which lacks facilities for "external modulation."

The harmonic content of an RF signal can be accentuated by means of a circuit along the lines of figure 11.

If not already terminated, the output lead from the generator should be loaded by the appropriate resistance value. Two diodes, connected in phase opposition are then inserted in the "hot" line to a circuit resonant at the frequency of the desired harmonic.

The harmonic output can be taken away, for example, through a pickup coil tightly coupled to the tuned circuit.

A typical application of this principle is for accentuating the harmonics from a 100 or 1000 Kc, frequency standard. The coil can be a plug-in arrangement and the condenser suitably calibrated. A multiple-spot frequency standard can be produced in this way.

VOLTAGE LIMIT

Care must be taken to restrict the voltage applied to the crystal to a value within its peak ratings.

The crystal diode has interesting possibilities also as a regulator for certain low voltage applications.

In a circuit such as figure 12, the limiting resistor is set to pass a bleed current approaching the maximum current rating of the particular diode. This happens to be 40 mA in the case of the 1N34. The voltage across the crystal will be maintained fairly constant for a wide variation in output current load.

R. P. Turner, in Radio and Television News, suggests a limit of 2.0 volts at 40 mA for a diode of the 1N34 type. Extra voltage or extra current capacity is obtained by connecting diodes in series or parallel.)

An unusual property of the germanium crystal allows it to oscillate in a resistive circuit if a high critical negative voltage is applied across it.

The diode passes very little current with a reverse potential applied until a potential is reached—generally about 100 volts—at which the current rises steeply.

If applied in series with a resistor, the high reverse potential will cause a high current to flow through the diode and therefore a large voltage drop to occur across the series resistor. The voltage across the diode therefore falls and the current also falls abruptly, restoring the original condition. An oscillatory condition can be created.

The circuit can be inter-connected with a step-up transformer to produce sustained oscillations up to a frequency of several hundred c/s. The waveform is normally peaked, unless resonant effects are introduced in the output circuit to correct the natural characteristic.

CORRECTION

The University Graham Instrument Co. have asked us to draw attention to an error in their advertisement in the 1950 Short Wave Handbook, in which an illustration of a portable radio set was supplied in place of the MK1 Multimeter Kit. Most of our readers will be familiar with both pieces of equipment, and are not likely to be misled. However, just in case, we mention the error for their notice.

The Short Wave Handbook is still available at mos newsvendors for 2/- per copy, but supplies are not expected to last much longer. If you have not already done so, get yours now!

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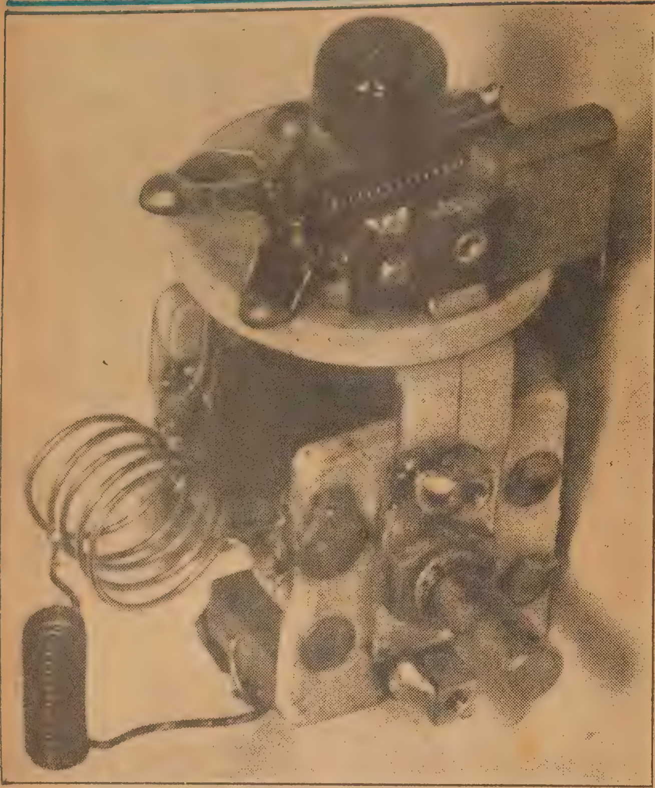


The tuning unit is built round a small split stator condensor to which a miniature acorn socket is attached with brackets. The coil is mounted to the condensor and the whole unit mounted to one side of the case.

A HANDIE TALKIE FOR AMATEURS

Nearly every amateur succumbs to the fascination of portable operation at one time or another. The equipment used varies from elaborate crystal controlled apparatus on the low frequency bands, to small handie-talkies on the higher frequencies. Great ingenuity is frequently represented in the devices produced as variations on standard design.

by John Moyle

THE higher frequencies lend themselves very well to portable work because not only can the equipment be made with few components and simple circuits, but the aerials required are correspondingly smaller than those demanded by lower frequencies.

This is especially true of the handie-talkie, actually a transmitter-receiver in a case small enough to be carried in the hand. A quarter wave or half wave aerial is little more than a short rod in this region, whereas on the lower frequencies, such a rod would represent a very poor radiator.

Recently, we had occasion to make some experiments with simple handie-talkie operating on high frequencies, and were faced with many of the problems which the amateur must solve. It is the purpose of this article to discuss some of these problems, and to suggest a basic design which can be used on the 144 or 288 mc bands, with or without elaborations, according to the ideas of the builder himself.

A commercial handie-talkie would be obliged to maintain a frequency stability of at least 0.3 per cent, which means, of course, a crystal controlled transmitter. As the receiver would be required to be non-radiating, probably some type of superhet would also be needed.

This would require miniaturisation of components, and a compact layout. It is extremely doubtful whether any but the most ambitious amateur would find the venture worth while.

Fortunately, on the bands mentioned, the regulations allow amateurs to use modulated oscillators with no limit on frequency stability other than the necessity to keep within the band, and super-regenerative receivers which, in their simple form, radiate almost as much as a transmitter using comparable battery power.

As a result, it is perfectly practicable to work out a simple, easily constructed transceiver with a couple of valves, which will do quite a good job over limited ranges, and over surprising distances which have line of sight conditions.

TWO TYPES

The two lines of attack in making such a handie-talkie are first, to build separate transmitter and receiver for inclusion in the same case.

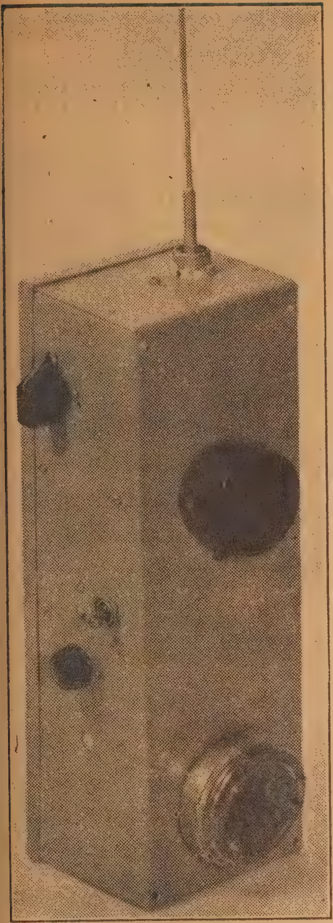
This is, perhaps, the best idea of all, but it means greater space for accommodation of the gear, and more complicated switch arrangements.

The other scheme is to use the same valves for transmitting as for receiving, switching the circuits about to suit. This is the simplest and most economical plan, and has been adopted in the construction of the handie-talkie detailed here.

What happens is that the first valve in the circuit is used as a modulated oscillator for transmitting and as a self-quenched, super-regenerative detector when receiving. The remainder of the circuit is used as an audio amplifier when receiving, and as a modulator when transmitting.

The aerial is not switched at all, a good point from a mechanical viewpoint, and it is possible to obtain a degree of aerial coupling which works quite well in each case.

The ingenuity previously mentioned, comes in when arranging a dual purpose for the various components. There are so few of them that this dual function is virtually a necessity if complicated switching arrangements are to be avoided.



A front view of the handie talkie. The tuning control is at the top—filament switch and regeneration control below it.

Commencing at the front end of the transceiver, we have to use a valve which will work efficiently at the frequency in mind. Like all other valves we might use, it must be a battery type, if high drain is to be avoided, although for amateur work, a short life from six volts of torch cells might not be a serious matter.

Easily the best valve for the work at 144 or 288mc is the 958, 958A, or 957, which are slightly different versions of the same thing—a battery triode of the acorn type. Ratings extend down to 500mc, a virtual guarantee that at 144mc the general efficiency will be satisfactory.

GRID LEAK VALUE

As the circuit for transmission and reception is essentially the same, no changes are required when switching from transmit to receive, with the exception of the grid leak value. This is changed from the more or less normal value for reception to about 25,000 ohms for transmission.

An RF choke is included in the grid leak which runs to the switch to render the lead "cold" and avoid troubles with oscillation.

The aerial coupling, as already mentioned, is unaltered.

In many cases, it will be quite satisfactory to run the high tension lead for this valve direct to the 67½ volt battery, controlling regeneration on reception by adjustment of the aerial coupling coil. However, it is possible to obtain better receiving results, particularly if a higher transmitting voltage is used, by including a variable resistance in the detector lead, so that the regeneration is controllable in the conventional manner. On 288mc, where operation becomes appreciably trickier to control, this addition will probably be found well worth while.

The tuning circuit uses a small split-stator condenser of a type taken from a small piece of VHF disposals equipment. There are plenty of these already in the hands of amateurs, and they can still be obtained from time to time.

SPLIT STATOR

The advantage of the split stator is mainly that the rotor may be at the same potential as the metal case, thus preventing hand capacity effects. A small single section condenser could be used, if an insulated shaft is coupled to it, and the condenser is mounted well into the case so that capacity effects do not cause detuning. The split stator has other advantages, of course, well realised on the other bands, and applicable in the main to this circuit as well.

Rough tuning of the coil is accomplished by squeezing together or spreading apart the turns, and normal tuning is done with the condenser itself.

One disadvantage of the circuit is that reception and transmission take place on approximately the same frequency.

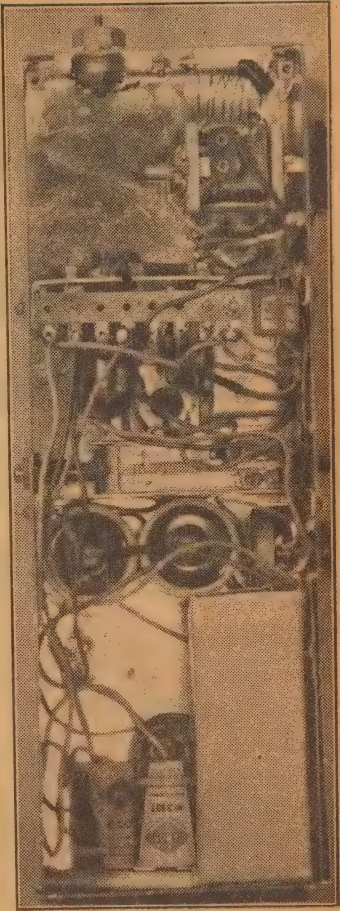
Unfortunately, it isn't exactly the same, due to the change in circuit constants involved when switching.

Where communication between two of the small units takes place, the slight difference between transmitting and receiving frequencies may be a bit troublesome unless the units are close to each other. If not, a progressive march through the band is likely to take place consequent on the retuning necessary at each "over." This is a tendency which must be watched with care to avoid moving out of the band.

CARE IN OPERATION

This might be the appropriate place to remark that further care should be exercised with these small units, particularly when other stabilised transmitters are working on the band, in order to avoid interference from frequency changes, from the rather broad signal transmitted by the handie-talkie, and because its receiver will radiate quite a strong carrier when receiving.

For obvious reasons, therefore, a handie-talkie should never be regarded as a standard equipment. On these higher frequencies, every amateur has a legitimate claim for experiment with elementary gear which would not be tolerated on lower frequencies, but this is no reason why he should cause more interference than he can possibly help, even on the odd occasions when he "goes portable."



The tuning unit is at the top, below it the small audio shelf, then the relay change-over switch, and finally the battery compartment.

Moving now to the audio end of the circuit, we have found a single valve quite adequate not only as an amplifier for reception, but as a modulator when transmitting. An earpiece is of course used in the one instance, and a standard carbon microphone in the other. A two stage audio amplifier is usually not required, giving either too loud signals on reception, or bad overmodulation and distortion on transmitting. Both these statements are subject to plus and minus according to the care taken with the use of an extra valve.

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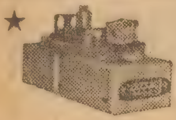

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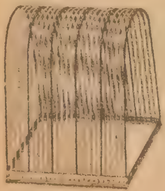

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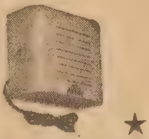

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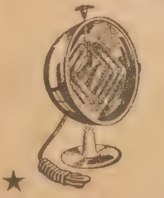

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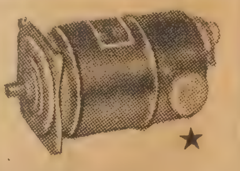

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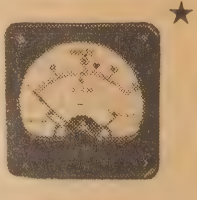

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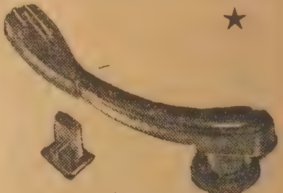
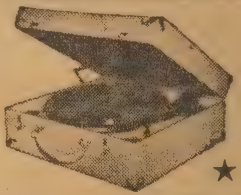
VP32250	32v., 250v., 45Ma.	6	13	6

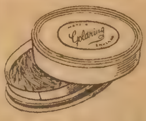


CRYSTAL PICKUP BARGAIN. Streamlined plastic lightweight high fidelity crystal pickups with only 1 to 1 1/8 oz. needle pressure. Price, as illustrated, cut to only 29/11.

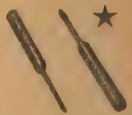


THE CAPITOL GRAMO. UNIT. Capitol Portable Electric Gramo. Unit. Complete with the new Collaro 504 motor. High Fidelity Crystal Pickup and automatic stop. Price, as illustrated, 12 Gns. Terms, 52/- dep., 4/3 weekly.

SUPER TRANSMITTING TUBE BARGAIN. Brand new American imported Eimac 100TH Tubes. Reduced from 8 gns. to 49/6.



GOLDRING SUPERFINE GRAMO. NEEDLES. Ten playings for each needle Plastic boxes of 100. 2/2 per box.



TEST PROBES. Available in pairs, red and black chromium. Insulated brass probes, per pair, 2/9, as illustrated

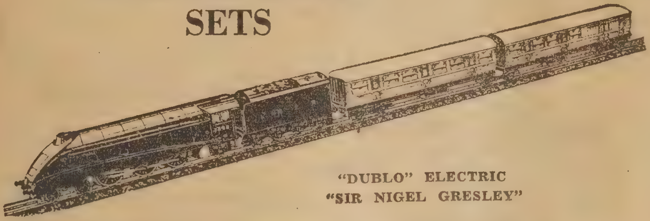
STOP PRESS BARGAINS!

Odd Shielded Coils, R.F., Osc., etc cut to	1/-
5 Valve Steel Drilled Duecoed Chassis cut to	1/-
Speaker Transformers, all primary impedances to 2.30 ohms	2/11
Portable loop aerials, cut to	2/11
Portable leatherette covered wooden cabinets	8/11
Speaker windings, standard 7000 ohms to 2.3 ohm. V/C.	1/11

290 LONSDALE ST., MELBOURNE—CENT. 4311

TOYS for Boys

HORNBY TRAIN SETS

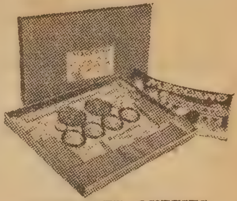


"DUBLO" ELECTRIC
"SIR NIGEL GRESLEY"

HORNBY "MO" Train Sets. Mechanical. Consisting of loco, tender, two trucks or passenger coaches and set of rails.	£1/12/9
HORNBY "M1" Train Sets. Mechanical, reversing. Consisting of loco, tender, two trucks or passenger coaches and set of rails.	£2/10/6
HORNBY "201" Tank Goods Train. Mechanical, reversing. Consisting of tank, loco, three different trucks and set of rails.	£3/14/-
HORNBY "501" Train Set. Mechanical, reversing. Consisting of loco, tender, three passenger coaches and set of rails.	£5/-/-
DUBLO "EDG7" Tank Goods Train. Electric with remote reverse and speed control. Consists of tank loco, three trucks and set of rails	£11/5/-
DUBLO "EDP2" Passenger Set. Electric with remote reverse and speed control. Consists of loco "Duchess of Atholl," tender, two coaches and set of rails.	£14/-/-

The DUBLO sets require a stepdown transformer, which is not included in the above. No. 1 transformer is 65/- extra.

MECCANO



COMPLETE OUTFITS

	£	s	d
No. 0.		10	3
No. 1.		16	6
No. 2.	1	2	0
No. 3.	1	12	0
No. 4.	2	5	0
No. 5.	3	3	0
No. 6.	4	0	0
ACCESSORY OUTFITS			
No. 0A.		6	3
No. 1A.		6	6
No. 2A.		12	0
No. 3A.		15	0
No. 4A.	1	2	0
No. 5A.		17	0
Gears Outfit "A"		16	6
MOTORS			
Magic Clockwork		9	0
No. 1. Clockwork	1	2	0

MINIC MECHANICAL TOYS

Rolls Royce Tourer	8 9
No. 2 Saloons	11 6
Timber Lorry	5 11
No. 1 Jeep	5 11
Vanguard Saloon	4 6

Traffic Control Car	6 9	Dust Cart	6 9
Car and Caravan	8 9	Petrol Tanker	5 3
No. 2 Police Car	12 6	Racing Car	4 6
Delivery Lorry	4 6	Steam Roller	6 9
Minic Mouse	3 6	Loch Ness Monster	8 9

TRIANG TOYS

Non-mechanical. Welded pressed steel construction for strength. Fitted with 3½" dia. wheels with tread rubber tyres. Length approximately 18".

Breakdown Lorry	32 6
Brick Lorry	34 6
Shell Tank Wagon	32 6
FROG "RAIDER" Flying model airplane 12" span	5 9
PENGUIN Plastic, Mechanical Cabin Cruisers	5 3
PENGUIN "Ford" rubber driven cars	4 1

There are several shipments of attractive toys—Airplanes; Boats; Soldiers; etc. due to arrive from overseas, shortly.

DINKY TOYS

Streamlined Train	8 5	Small Racing Car	1 6
Trailer	2 6	Bedford Tipper	7 6
Diesel Roller	6 3	Bedford Truck	5 9
Farm Tractor	5 8	Manure Spreader	6 9
Motocart	7 9	Mech. Horse and Wagon	3 3
Motor Cyclist	1 7	Road Signs (Set)	6 3
Petrol Pumps (set)	5 8	1950 Ford Sedan	4 6
Grass Cutter	3 0	Gardener's Truck	3 6
Garden Roller	1 4	Twin Engine Fighter	10

DINKY SUPER TOYS

Foden 14-ton Tanker	15 0	Guy 4-ton Lorry	7 9
Guy Van	9 9	Muir Hill Dumper	10 9
Heavy Tractor	10 3	Guy Flat Truck	7 3

The above is a small representative selection of our range of high-grade toys. An illustrated catalogue is available and we suggest you write for your copy now. Use our LAY-BY, and thus reserve the toys you want at Xmas.

PRICE'S RADIO

5 & 6 ANGEL PLACE - - - SYDNEY

RANGE FINDERS

Horizon and Bubble Type. A beautiful precision-made instrument with valuable lenses and revolving calibrated disc. Can be used for measuring depression as well as elevation in feet. Original cost to R.A.A.F. £35.

Our Price, Each **£10/10/-**

Post Free.

Military Overcoats

For warmth and hard wear, these Coats are unexcelled.

OUR PRICE, **30/-**

Sizes: S.M. and M.
Post 2/-; Interstate, 3/6.

CALICO

Super quality calico by the ROLL! This is the best quality we have handled for some time. In 30yd. Rolls, 36in. wide.

PER ROLL **78/6**

Post Free.

Or in 5yd. lengths **11/3**

Post 1/3 extra.

P.M.G. ADJUSTABLE MORSE KEYS

Genuine P.M.G. Morse Keys, with adjustable buzzer, brand spanking new. Cost the Army £4/10/-.

OUR PRICE .. .. **10/- ea.**

Without batteries, which are easily obtained at any electrical store.

Postage: N.S.W., 1/6; Interstate, 2/6.

Only 10/- ea.

ARMY WORSTED SHIRTS

Jungle Green Work Shirts, made from soft Wool De Chene material. Will stand tough wear. Sizes 17 to 18 inches neck. Unsurpassed value. Shirt with separate collar **14/6**

Shirts with attached collar **17/6**

Post 9d; Interstate, 1/3.

BLUE DRILL WORK SHIRTS

All sizes, a good, strong wearing shirt.

Each **14/11**

Post: N.S.W., 9d; Interstate, 1/3.

Bearing & Distance Plotter

For measurement of bearings and distances. It is provided with a protractor and scales. Made of celluloid.

Price, each **3/-**

Post 6d.

COURSE & WIND CALCULATOR

A super precision made instrument. All aluminium. Original cost to R.A.A.F. £24. Our Price, Complete with well-made wooden case, 12" x 12" x 4".

Only, each **£3/10/-**

Post: N.S.W., 1/-; Interstate, 1/6.
LUMINOUS DIALS.

AIRCRAFT FUEL GAUGES

190 Gal. Capacity. Cost R.A.A.F. £25.

Our Price, each **10/-**

Post, 1/6 extra.

Imported Prismatic Binoculars

We have a grand assortment of Binoculars, including some of the best German, English, and French Makes.

LARGE RANGE AVAILABLE

6 x 24 ..	£10 10 0	Wide Angle	£12 10 0
6 x 30 ..	12 10 0	Wide Angle	14 10 0
8 x 24 ..	13 10 0	Wide Angle	15 10 0
8 x 30 ..	15 10 0	Wide Angle	17 10 0

Wide Angle 7 x 50 .. £25 0 0

Well packed. Post, Ins. Free.

GROUND SHEETS

Brand New Ground Sheets, 74 x 38. £1 value.

Special Price, each **13/6**

Post: N.S.W., 1/-; Interstate, 1/6.

FEATHER SLEEPING BAGS

Warm and cosy lightweight bags, weight only 3lb., roll up into small carrying bag.

Each **77/6**

Post: N.S.W., 1/9; Interstate, 2/6.

Khaki Drill Jackets

Coat Style, ex-R.A.A.F. In sizes SM and M.

Only, each **9/6**

Post: N.S.W., 1/-; Interstate, 1/6.

Gas Bottles

As used to inflate rubber dinghies. Will hold many pounds of pressure. Approx. 12 inches long, 3 inches in diam., weight 3½lb. Sturdily constructed with screw top release valve.

Only .. .. **10/- ea.**

Post: N.S.W., 1/6; Interstate, 2/6.

OIL PAINT

A genuine Oil Base Paint, extra good quality. Grey, Red, Cream, White, Chocolate, Light Stone, Dark Stone, Mid Stone, Green.

1 Gallon Tin **£1/7/6**

4 Gallon Drum **£5/-/-**

Please add 1/6 per drum cartage to rail. Freight payable at your nearest attended railway station.

SPEED INDICATORS

Perfect Condition made by Elliott Bros., of London. In three ranges:—100 to 500 Revs, 400 to 2000 Revs, and 800 to 4000 Revs.

£5/15/- ea.

Post 2/6 extra.

GREY BLANKETS

Pure Wool Army type, 3½lb. in weight. 78in. x 56in. Brand NEW.

Each **37/9**

Post: N.S.W., 1/3; Interstate, 2/-.

TRAVELLING RUGS

Pure Wool, soft and woolly, in pleasingly colored overchecked designs, 3½lb. in weight. Brand NEW **46/6**

Post: N.S.W., 1/3; Interstate, 2/-.

OUR LATEST DISPOSALS PURCHASES

ALL EX-R.A.A.F.

SUPER QUALITY ELASTIC CORD
in 40ft. Lengths.
3/16in. in diameter.

This cord is comprised of 14 strands of best quality elastic and covered with cotton. Price, per 40ft. length .. **6/6**

COURSE and SPEED CALCULATORS

A beautiful precision made calculator with Port Drift and Starboard Drift Indicator, may be used for many types of calculating. Complete with neat dovetailed wooden case, 11" x 6" x 2¼", fitted with brass hinges and catches and leather handle. Cost Air Force £12/10/- each.

Our Price, Each **15/-**

Post: N.S.W., 1/3; Interstate, 2/-.

COMPUTORS

Height and Airspeed Computors, aluminium calibrated disc types. Original cost £7/15/-.

PRICE, Each **7/6**

Post: N.S.W., 1/-; Interstate, 1/6.

American Directional Gyro Indicators

Brand New. Contain a specially precision made Gyro.

ONLY, each **15/-**

Post: N.S.W., 1/3; Interstate, 2/-.

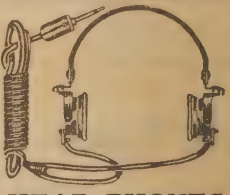
Aircraft Luminous Compasses

Brand New. Liquid filled, 3½" diameter x 3" deep. Ideal for ships, small-craft, etc. Original cost £19.

Our Price, each **£3/15/-**

AND SLIGHTLY USED. **£2/10/-**

Post: N.S.W., 2/-; Interstate, 3/-.



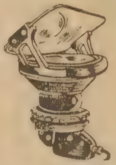
HEAD PHONES

Brand new S.T.C., complete with cord and plug.

2000 ohms Impedance **£1/4/6**

Suitable for crystal sets. Postage 1/6 extra.

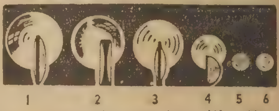
REFLECTOR GUNSIGHTS



Ex-Air Force. Containing best quality condenser lenses and adjustable reflector. Parts can be used for many purposes.

£2/5/- ea.

Postage 2/6 extra.
COMPONENTS INCLUDE THESE VALUABLE LENSES.



No. 1 Diam. 3⅜ Foc. Len. 10in. No. 2 Diam. 3¾ Hollow Ground. No. 3 Diam. 3¼ Foc. Len., 4½in. plus No. 4 Diam. 2⅝ Foc. Len., 6½in. plus No. 5 Diam. 1⅛ No. 6 Diam. 1-18 Amber Coloured ordinary.

Sorry, No. C.O.D.

SPECIAL ATTENTION PAID TO MAIL ORDERS AND WE GUARANTEE PROMPT DELIVERY.

DEITCH BROS.

DEPT. R, 70 OXFORD STREET, SYDNEY.

TRADE REVIEWS AND RELEASES

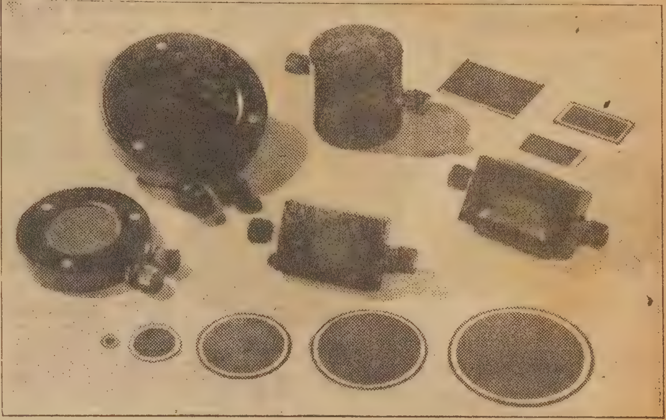
VALVES FOR RADIO CONTROL

BRITISH Merchandising Pty. Ltd. advises that they are importing limited stocks of a sub-miniature "Hivac" gas triode, type XFG-1. Intended for the control of model aircraft, &c, the XFG-1 measures 38 x 9.8 x 7.2 mm excluding leads. The construction presumes that the lead wires will be soldered directly into the circuitry and no base is provided.

Rated for intermittent rather than continuous service, the valve has a 1.5 volt, .05 amp filament. Maximum plate voltage is 45 and maximum plate current 2.5 mA.

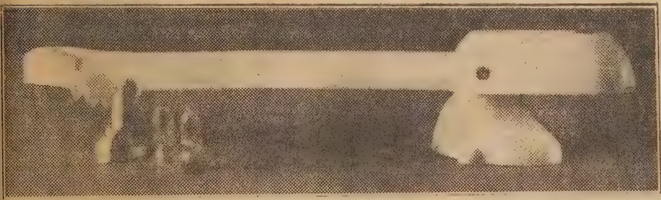
Further details and price are available on application to British Merchandising Pty. Ltd., 183 Pitt Street, Sydney.

PATON HANDLES PHOTO-ELECTRICS



The above picture shows a group of Megatron selenium photocells which are handled in Australia by Paton Electrical Pty. Ltd., of 90-94 Victoria Rd., Ashfield, NSW. The Company also advises that they are local agents for all Megatron products, including a color temperature meter, a cosine corrected light meter and a variety of selenium photocell devices. The items are produced under supervision of Dr. G. A. Veszi, a noted authority on such matters. Some of them are used in equipment manufactured in Australia by Paton Electrical. Details of prices, stocks, &c. are available on application.

GOLDRING 3-WAY PICKUP



Having built up an excellent reputation on the American market, the Goldring "Three-Way" pickup has now been released locally.

REASON for the name lies in the fact that the pickup has been designed to accommodate 33, 45 and 78 rpm records. For playing 33 and 45 rpm discs a .001" tip is used, while a .003" radius tip is suggested for 78 rpm discs. The stylii are color-coded for identification and can be inserted and withdrawn easily using the fingers only.

The weight on the tip can be varied from 7 to 14 grams, as required, by setting a sliding counterweight at the rear of the arm. The arm is of light cream plastic and gives negligible evidence of resonance effects in the bass register.

The coil impedance at 1 kc is rated as 3000 ohms, optimum load as ./5 megohm, and nominal output from a test record as 150 millivolts. Bass compensation is required, as for any magnetic lightweight pickup.

On test, a sample pickup exhibited a generally clean waveform, being well above average in this respect. The response was substantially level right up to about 7 kc. A slight rise of some 2db. was evident in the 9 and 10 kc region, but tending to roll off around 14 kc.

Retail price of the Three-Way pickup, through all Goldring distributors is £6/17/6.

MAIL ORDER SPECIALS
FOR
PHOTOGRAPHERS!

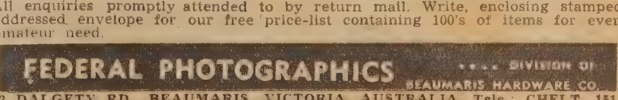
Movie make with these FEDERAL Specials from Australia's Mail Order Specialists:—

Kodak 8 mm Model 20 cine camera plus Meopta 8 mm latest model projector complete with carrying case, spare reel, etc., plus 1 spool 8 mm film.

Federal Photographics Price, all inclusive, £65/-/-.

DARKROOM FORCEPS

Avoid stained fingers with these stainless steel forceps. FOTOX forceps (left) 3/6 each. Spring loaded type (right) 5/3 each.



All enquiries promptly attended to by return mail. Write, enclosing stamped, addressed envelope for our free price-list containing 100's of items for every amateur need.

FEDERAL PHOTOGRAPHICS .... Division of BEAUMARIS HARDWARE CO.
22 DALGETY RD., BEAUMARIS, VICTORIA, AUSTRALIA. Tele.: CHELT. 1511.

BATTERY CHARGING GENERATORS

All generators checked and tested before despatch.

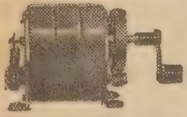
	£	s.	d.
24 Volt 1500 Watt ..	12	10	0
12 Volt 500 Watt ..	10	10	0
12 Volt 750 Watt ..	12	10	0

The 24-volt 1500-watt Generator can be used for 32-volt system without any alteration.

24 Volt Regulator and Cut-out

Made by Bendix Aviation Corporation. Suitable for use with above generators in home lighting plants.

Can be adjusted for use on 32 volts system. **£3/10/-**



BELL-RINGING HAND GENERATORS

Suitable for installing in the Don V Telephone to convert to Bell Call System **37/6**

Postage and Packing: Vic., 1/6; N.S.W., S.A., Tas., 2/3; Qld., W.A., N.T., 3/-.

COMPASS, TYPE P.8

5¼in. dia. x 2¼in. deep, accurate Aircraft type navigation compass.

Reconditioned as new. **37/6**

Vic., 2/-; N.S.W., S.A., Tas., 3/6; Qld., W.A., N.T., 5/-.

WESTERN ELECTRIC U.H.F. FOUR VALVE MIDGET RECEIVER

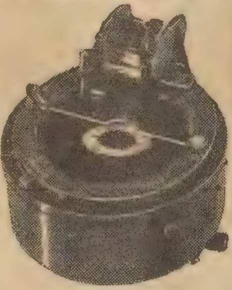
Frequency 238 to 258 Megacycles Valves 3—945, 1—955 Super Regenerative Receiver. **£2/19/6**

Postage and Packing: Vic., 2/-; N.S.W., S.A., Tas., 3/6; Qld., W.A., N.T., 5/-.

Waltham TRADING Co

393 Flinders St., Melbourne, C.1.

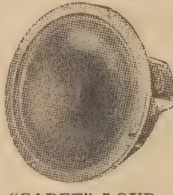
Mail Orders Dept.: 319 Swanston St., Melbourne.



COMPASS

Liquid Damped, Card Type. 6½" dia. x 3½" deep, fitted with large viewing prism, ideal for small craft, etc., for normal navigation and also taking bearings.

Each **£6/10/-**



"CADET" LOUD-SPEAKERS

6" Permag. Without transformer, 15/-. With 1500 transformer, £1.

Postage and Packing: Vic., 1/6; N.S.W., S.A., Tas., 2/6; Qld., W.A., N.T., 3/6.

ARMY FIELD TELEPHONES

Ideal for use in woolsheds, indoor or outdoor communications up to 5 miles. These are English "H" Type phones, very similar to the Australian "L" type except that they incorporate a voice-powered handset and do not require batteries. Also a "C" Type generator and bell is installed. Brand new.

EACH **£3/17/6**

Postage and Packing; Vic., 3/6; N.S.W., Tas., S.A., 5/-; Qld., N.T. W.A., 7/6.

BLOWER MOTORS

80 volt D.C., with Laminated Field. Approx. 1/20 H.P. £2/5/-.

Postage and Packing: Vic., 2/-; N.S.W., Tas., S.A., 3/6; Qld., W.A., N.T., 5/-.

METAL DETECTOR

"It Whistles While It Works."

The wartime mine-detector is now doing a very useful peace-time job, and has proved invaluable to **PLUMBERS, GAS FITTERS and MUNICIPAL COUNCILS.** It originally worked on the principle of finding the metal casing of mines. It would just as easily—in fact, frequently did—find the coins in the pockets of the user. When it found them, it whistled.

Metal pipes and cables can be traced quite deep down in the ground. This saves the laborious, costly and time-wasting digging of "search holes," when the underground path of the pipes is uncertain, as it frequently is.

And throughout all, the metal detector "whistles while it works."

The units contain two interchangeable sweep coils, one large and one small, and pack complete with valves and headphones. Packed in stout wooden transit case, 10" x 12" x 4' 6".

PRICE, each .. .. **£8/10/-** Total weight, 80lbs.

AIRCRAFT GILL MOTORS

These contain a 24 volt motor, approx. 1/10th H.P., that can be revolved in either direction, A/C or D/C. A magnetic brake and a 5000 to 1 reduction gearbox.

Price, each **£2/17/6**

TANK WHIP AERIALS

Two four foot sections, ideal for car aerials, or fishing rods. Each **15/-**

R.A.A.F. NAVIGATORS' PLOTTING BOARDS

18" x 18", complete with Pantograph **17/6**

PROPELLER FEATHERING MOTORS

24 volt D.C. with laminated field. 600lb. hydraulic pump **£3/15/-**

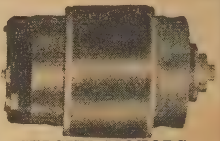
ALL GOODS CONSIGNED "FREIGHT PAYABLE ON DELIVERY" UNLESS OTHERWISE STATED — SORRY! NO C. O. D.

ENGLISH THROAT MICROPHONES

Magnetic type, high output, may also be used as contact microphones on musical instruments or adapted for use as a pick-up for electric guitar. Comprises two microphone units which may be used separately.

Brand New **12/6**

Postage and Packing: Vic., 9d; N.S.W., S.A., Tas., 1/-; Qld., W.A., N.T., 1/3.



SELSYN MOTORS

50 volt 50 cycle, ideal for use with Rotating beam aerials **30/-**

Postage and Packing: Vic., 2/-; N.S.W., Tas., S.A., 3/6; Qld., N.T., W.A., 5/-.

R.A.A.F. ASTRONOMICAL INSTRUMENT can be utilised to measure horizontal and vertical angles such as those encountered in road making and irrigation work. It is fitted with scales calibrated in degrees, two levels and adjustable turntable mountings **£2/15/-**

Postage and Packing: Vic., 2/-; N.S.W., Tas., S.A., 3/6; Qld., N.T., W.A., 5/-.

TELEPHONE HAND-SETS

Standard P.M.G. Type, complete with cord and 4-pin plug. Brand new 37/6

Postage and Packing, 2/6, all States.

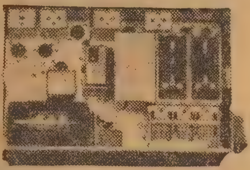
HYDRO-METER

For Temperature and Humidity readings, as supplied to the Air Force. No Home, Farm, Factory or Dairy should be without one of these.

Price **19/6**

Postage and Packing: Vic., 1/6; N.S.W., S.A., Tas, 2/-; W.A., Qld., N.T., 2/6.

BENDIX AIRCRAFT COMMUNICATIONS RECEIVERS RA10FA



Frequency range 4 bands 150-400 kcs, 2.0-5.0 mcs, 2.0-5.0 mcs, 5.0-10.0 mcs. H.T. dynamotor 24v input 250v at 100 mA output. Small 24v A.C./D.C. motor. Filaments wired for 6v A.C./-D.C. Socket ready mounted and space for rectifier and A.C. power supply. Valves used: 3—6SK7, 6K8, 6R7, 6C5, 6H6, 6K6.
Price, less valves F.O.R. **£11/10/-**
Remote control box with calibrated dial, etc., to suit above. Each . . . . . .

4W FLUORESCENT LAMPS

Colour: Blue. Length, 5½ inches. Ideal R.F. indicators.
Price, Each **2/6**
Per Dozen **25/-**
Packing and postage, 6d each.

FS6 VIBRATOR SUPPLIES

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852	25/-	VT90 Micropop	10/-

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6J7G	12/6	866A	25/-
6K8G	12/6	879/2X2	15/-
6SQ7	12/6	1293	11/6
6X5GT	12/6	1294	11/6
7A6	10/-	VR54/EB34	5/-
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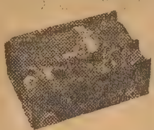

68 volt input D.C., regulated and filtered output filtered D.C. 300 volts at .26 amps; 150 volts at .01 amps; 14.5 volts at 5.0 amps. Completely shielded in metal case, 12 x 8 x 5 inches.
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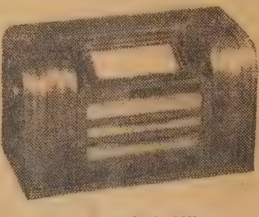

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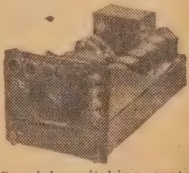

Complete with 11 valves: 2—R.F. stages, 954 acorns; mixer and oscillator. 2—955 acorns; 30 mcs. I.F. channel, 4—6AC7's; detector 6H6; cathode follower 6AC7; rectifier 5V4G. Coaxial switching motors 2-volt D.C. Frequency range, 160-190 mcs.
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Field type complete with magneto, bells and sound-powered push-to-talk handset (no batteries required). Mounted in metal carrying case with strap. Size 10 x 5½ x 4½ inches.
Brand new in original sealed cartons.
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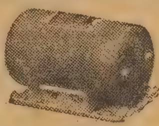

Command type as illustrated, 28 volts, 1.1 amp. input. Output 250 volts, 60 mA	32/6
14 volt input, output 220v. 70/80 mA. filtered	50/-
No. 11 type 12 volt input, output 350v. 40 mA.	30/-
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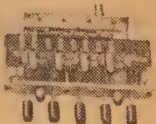

5-pole each 2 pair of contacts. Made in U.S.A. Ideal for receivers, multimeters, etc.
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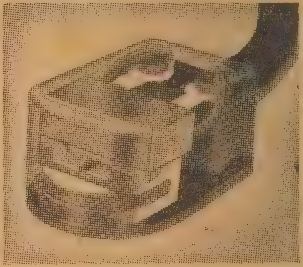
The Connoisseur
new miniature moving iron

Here's the pick-up you've wanted and it was worth waiting for! The Connoisseur appeals as much for its technical excellence as its superbly faithful reproduction—which tests will prove to be unsurpassed. Needle chatter is reduced to the point of inaudibility, while there is no distortion of treble or bass notes, giving flawless fidelity in reproduction. The pick-up head, which is only about half the size of its competitors, is an indication of the fine degree of accuracy built into it. Every part is subjected to the severest tests before being assembled into the neatest pick-up on the market.



● The miniature head shown in X-ray form is a fascinating piece of precision engineering.

At double pianissimo or double forte there is no distress, and at full amplification on a three-stage amplifier there is no distortion of bass or treble notes. Every pick-up is tested for a correct response curve. Test one for yourself.

TECHNICAL DATA

The pick-up coil is of high impedance, being 1,300 Ohms at 1,000 CPS. The output direct from pick-up is .1 volt from a standard recording of 12 db up on the zero reference level 1 cm/sec. RMS velocity.

With our special coupling transformer the voltage across the secondary will be approximately .5 volt.

FREQUENCY RESPONSE

Taking 1,000 CPS for our reference level the output falls steadily and at 8,500 CPS the loss is 5db at 12,000 CPS, the cut is 9 db down.

The response from 1,000 CPS down to 50 CPS remains level. Bass resonance, which gives a steady lift from the 50 CPS mark and is approximately 4 db's, occurs at 25 CPS.

. . . and the "Connoisseur" Gramophone Motor

AT LONG LAST !

A gramophone motor to match the performance of the famous Connoisseur Pick-up. Here are the specifications: 200-250 volts AC, 50 cycles . . . Rim drive with speed variation . . . No governors and no gearing. Heavy non ferrous turntable . . . dead true fly wheel action. Motor runs in needle point self adjusting bearing. Plastic $\frac{1}{4}$" Motor Board. Pressure on drive wheel released when not in use.

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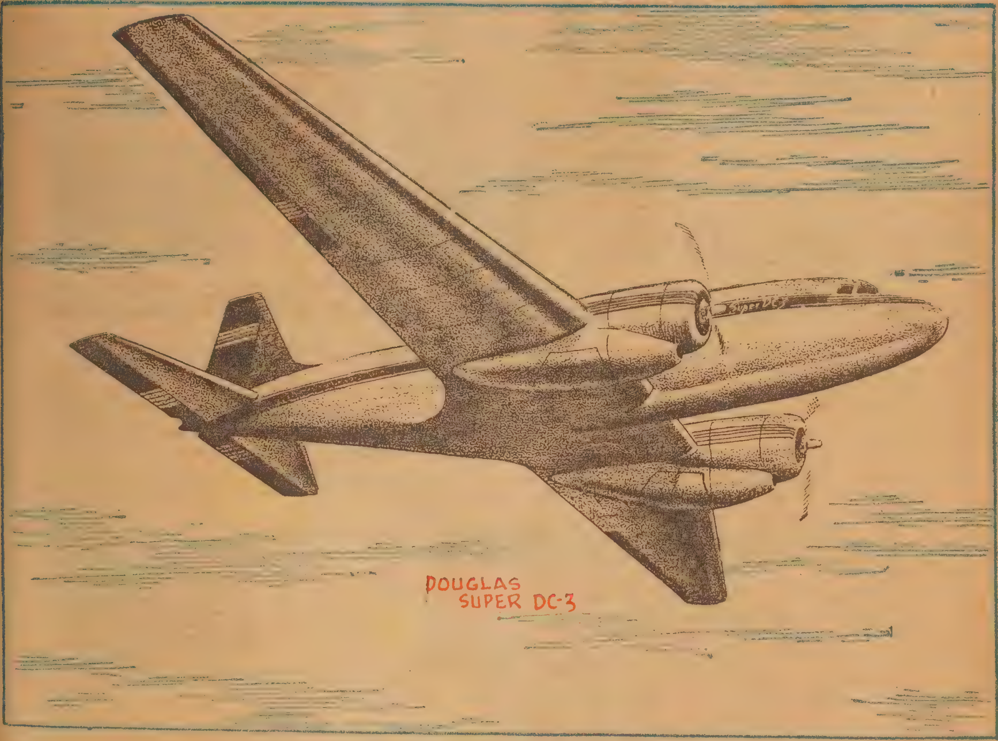
FAMOUS DC3 IN A MODERN DRESS



Perhaps the most famous aircraft ever built, the twin-engined medium-range Douglas DC3 Skyliner has been gracing the world's skyways for well over a decade. Now it has been given a new lease of life in the pre-jet interim, and the Super DC3 has emerged to carry this notable and popular aircraft into postwar aviation.

MORE than 12,000 DC3's had been built by the Douglas Aircraft Co. when the firm announced last year that a modified version had been produced. Conversion of existing DC3's was possible, the company announced.

Advantages are that speed, climb, stability, payload and economy are increased by taking advantage of the newer, more powerful engines now available, while efficiency in the loading of passengers and freight can be increased by design modifications. All this can be achieved without having to train air or ground crew in the handling of a new aircraft.

An increase in operating performance of 20 per cent. is claimed for the Super DC3's. It is produced by Modifications, allowing the installation of more powerful motors (with three types to choose from), a re-designing of the outer wing panels and a lengthening of the fuselage to 67ft 8½in, and a 5ft reduction in wing-span.

Compared with the standard DC3, the new version has an additional 550 horsepower available for take-off.

The Super DC3 has a top speed of 270 miles an hour and a cruising speed of 250 miles an hour—a 40 miles an hour increase. Passenger capacity has been raised and arrangements can be made to accommodate from 30 to 38 people. Payload is about 2000lb greater, the amount varying slightly according to engine installation.

IMPROVED HEATING

Up-to-the-minute features now incorporated are integral passenger-loading steps and an improved cabin heating system. Other design changes include the provision of an easily accessible rear cargo compartment at near ground level, fully enclosed main landing-gear wells, high-pressure hydraulic system, and a retracting tailwheel. A bird-proof windshield is fitted.

Alternative engines are the 1475-horsepower Wright R-1920-C.9HE, the 1450-horsepower Pratt and Whitney R-2000-D.5, and the R-2000-D.7 Power rating of the D.5 and the D.7 is essentially similar, but the D-5 is fitted with a torque nose, permitting automatic feathering which allows an increase in gross weight to 29,500lb, as with the automatic feathering Wright installations.

When the Super DC3 was announced, interest was expressed by Australian airline executives in the possibility of conversion of existing DC3's, which it was felt in some quarters might be profitably undertaken. Shortage of dollars was a major influence in the decision not to undertake modification, but the inability to pressurise the aircraft, and so bring it up to the latest luxury standards was another factor. Conversion within Australia was mooted, but nothing further has been heard of this project.

Although it is challenged by the introduction of turboprop and even jet airliners, the Super DC3 is nevertheless an interesting adaptation. On many of the world's airways it seems certain to give a new lease of life to a justifiably famous aircraft.

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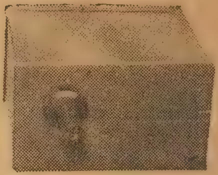

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Interchangeable head for microgroove.

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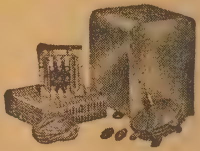

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12 volt, 2 amp. Kit, 5/- extra.

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Motor and magnetic pick-up. Auto-stop — 10" turntable.

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With Crystal Pick-up £6/-/-

GARRARD TYPE 'S'

10" turntable with magnetic pick-up. Auto-stop.

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AGAIN AVAILABLE

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RADIO CONTROL OF MODEL AIRCRAFT

PART TWO

In this article, Mr. Miles continues his survey of radio control methods for models. Next month he will conclude with final details and some further information on later developments.

By GIL MILES

THE unit at the top left, with its circuit diagram of Fig. 13, is driven by a small permanent magnet field motor running from 3 volts. Gearing of 900 to 1 and two limit switches, not visible in the photograph, allow the control-arm to move about 10deg. on either side of the centre position.

By using two receivers or two channels on the one carrier, as will be explained later, this continuously reversible motor control unit can give a precise and instantaneous degree of control, in contrast to the earlier sequence systems.

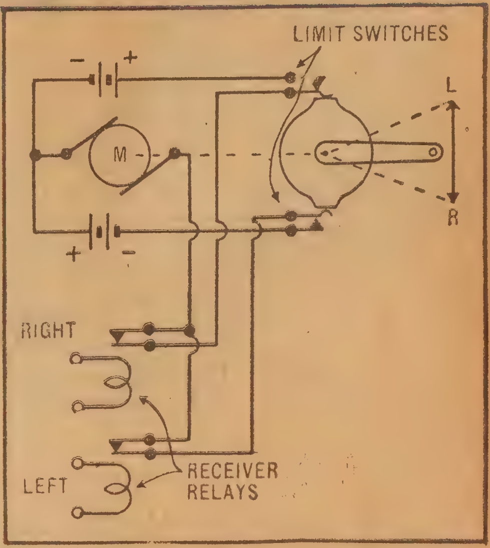

Figure 13—Circuit diagram of the motor control unit described herewith.

The unit at the bottom left of the picture is made up of a pivoted armature held centrally between two electro-magnets. With the arm coupled to a rudder, whichever coil is energised by the receiver's relay turns the rudder in that direction, with an automatic return to centre when the control signal ceases. (Circuit Fig. 14.)

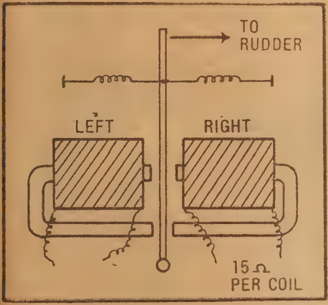

Fig. 14—Electro-magnetic actuator.

This last unit can also be used to control the movement of a "Ruddervator."

A fairly recent American idea, the Ruddervator makes use of a freely rotating vane as the control surface. Mounted where the usual rudder and elevator would be, it is so shaped and positioned that the model's movement through the air will rotate the vane at a lazy rate. (Fig. 15.)

As its name implies, if stopped at any of four selected positions it functions as a rudder or an elevator. Reference to Fig. 16 will show how it can be used in conjunction with the electro-magnetic actuator to function as a rudder.

There are many variations of the simple sequence system, such as using more than one transmitter and receiver—on different frequencies, of course. This does not present such a difficulty as might at first be expected, because receivers can be made to weigh as little as 3oz and will all operate from a common battery supply.

While it must be admitted that sequence control will allow a lot of good flying, it is an advantage to be able to select the control function you want, instantaneously, without having to worry about going through a whole sequence to get it. The use of a number of audio tones to modulate a carrier is one way to achieve this. Up to 10 tones in the range 300 to 10,000 cycles have successfully been used; but a receiver to accommodate 10 tones is a little outside the scope of the average amateur workshop, so a two-channel equipment is presented.

Almost any type of transmitter that is capable of being plate-modulated by two particular audio control tones will suffice. For the receiver, the antenna, detector, and audio amplifiers are all normal, but the relay stages are specially tuned to accept the selected tones.

TUNING

Consider the diagram of Fig. 17. The receiver output is fed to two miniature transformers, with their primaries connected in series and each secondary tuned to one each of the tones. Fig. 18 shows another

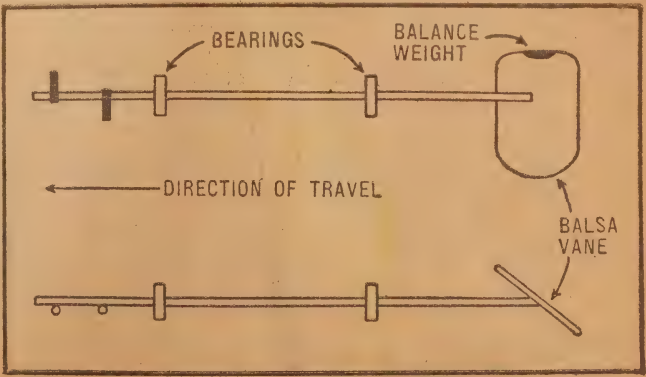

Fig. 15—Showing shape and angle of Ruddervator.

BUILD YOUR OWN HOLIDAY RADIO

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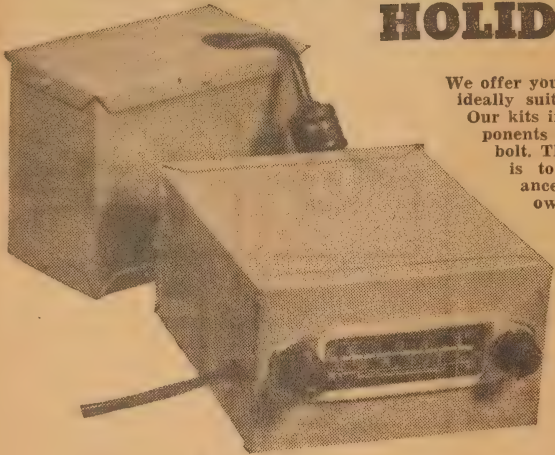


KAR-SET. A neat compact car radio designed for 6 or 12 volt operation. This 5-valve set, because of its special design, will give the performance of a six-valver. The strong metal box is finished in latest sprayed brocade process. Size of units are as follows:—Receiver box, 6¼" long x 3¾" high x 7¼" deep; power supply box, 3¾" high x 6¼" wide x 5¼" deep; speaker box, 7¾" x 7¾" x 3⅝" deep. Because the placement and type of speaker and aerial varies with individual cars, these items are not included in the kit. Price for kit **£17/4/-**

If you require 6" Per. Mag. speaker with speaker box to suit and 6ft. 3-piece side or fender mounting aerial, the price is £4/11/- extra. Total, £21/15/-.

THE SENIOR PORTABLE. The ideal portable for camp or caravan, country trips, weekends and indeed upon any occasion when you require a portable with maximum range. This handy to carry 5-valve broadcast portable is complete with R.F. stage and 7" speaker. Finished in handsome leatherette-covered cabinet with or without hinged front lid. External dimensions excluding lid and handle, 12½" long x 8¼" high x 6½" deep. Price for the complete kit (without lid) **£17/9/-**

With lid £17/19/-.

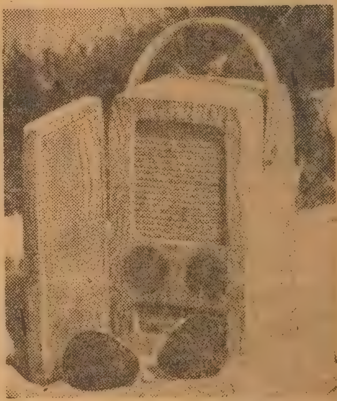
CARRY SET. The very latest in small portables, this 4-valve broadcast model does look outstanding in its new style carrying case. Ideal for holidays, or all the year round for that matter. Price for complete kit including cabinet **£11/19/-**

(External dimensions excluding handle, but including lid, 4½" wide x 8¼" high x 4¼" deep.)

ECONOMY 5. A 5-valve broadcast receiver, vibrator operated, which is ideal for the caravan, launch or private home. It can be operated from a 6 or 12 volt accumulator and is specially designed for economy. It draws only .75 amp., not much more than the current drawn by an ordinary motor-car tail light. Available with or without handsome leatherette covered cabinet as illustrated. Size, 14½" wide x 9" high x 8¼" deep. (Accumulator not supplied) Price without cabinet **£18/5/-**

Price with cabinet £20/12/-.

THE SENIOR PORTABLE



THE CARRY SET

ECONOMY 5

KIT-SET CATALOGUE

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nd probably a better way to achieve e same result. Two series resonant lters have been connected between e audio amplifier and the relay alves.

In each case the relay valves are iased to nearby cut-off and, with e arrival from the transmitter of ther of the selected tones to which e transformer and/or the filter ave been tuned, a maximum voltage ill appear only at the grid of the orrect or corresponding valve.

This voltage overcomes the bias, e valve conductor, and the increase anode current closes the relay. bout 0.25 volt RMS is required at e grid of the 1S5 fully to operate e circuit of Fig. 18—i.e., increase e anode current from 0.2mA tanding) to 2.0mA.

Further channels can be added to is arrangement by simply conecting more tuned circuits in parlel and providing more relay valves nd relays; but precautions must be ken to allow sufficient separation etween adjacent channels, which an only be determined properly by boratory equipment.

AREFUL PLACEMENT

Careful placement of parts and terwiring is necessary to ensure at the quench voltage from the etector does not leak into the relay tages to reduce their sensitivity. he .001mfd capacitor connected om the 1S5 anode to filament will o much to bypass this now unanted voltage.

As an alternative to using filters nd transformers in the receiver relay tages, tuned reeds have something to ffer, as shown in the two-channel rrangement of fig. 19. Two steel eeds about 1¼in long, 1-8in wide and 10in thick are soldered to a brass ridge so shaped that one reed has a nger free length than the other. ounted as shown, above a pair of oils and a permanent magnet, each eed will vibrate only when its own articular audio-frequency is applied the coils.

The two coils in series are conected in the anode circuit of the reeivers' amplifier valve, which is ormally biased. The reed contacts onnect high resistance relays into ircuit, which in turn control the ctuating devices.

The reeds, of course, pulsate at the equency to which they are tuned, a filter network comprising a .25 mfd. capacitor and 15,000 ohm resistor is necessary to smooth the intermittent current from the reed contact, for proper operation of the following relays.

The reed selectors would have to be well made to be reliable.—Fig. 20. The use of pulses for control purposes opens up a very wide field experimentation, two systems, one sensitive to pulse length, and the other to pulse rate, will be described.

The circuit of fig. 21 will respond to a transmitter plate modulated with an audio tone which is keyed to give short pulses for rudder left and long pulses for rudder right. The relay valve is biased to cut off, because its cathode is returned to filament positive. Connected in the grid circuit is a series-tuned filter responsive to the selected audio tone. The three relays, RL1, RL2, and RL3, are all the same type, and could be the ex-disposals type described earlier.

OPERATION

When short pulses of the correct frequency are applied to the relay valve, its anode current will rise from zero to about 3.5 ma and RL1 will follow the short pulses, the contact S1 will operate RL2, S2 will remain closed, due to the time-lag intro-

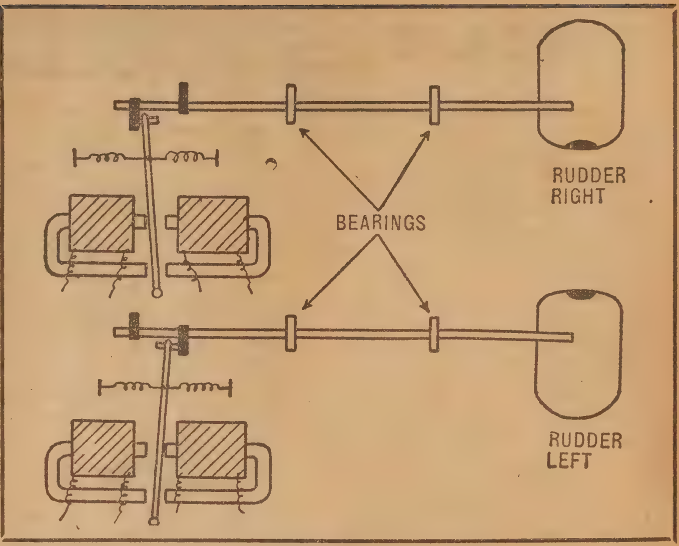

Fig. 16—The Ruddervator in two positions.

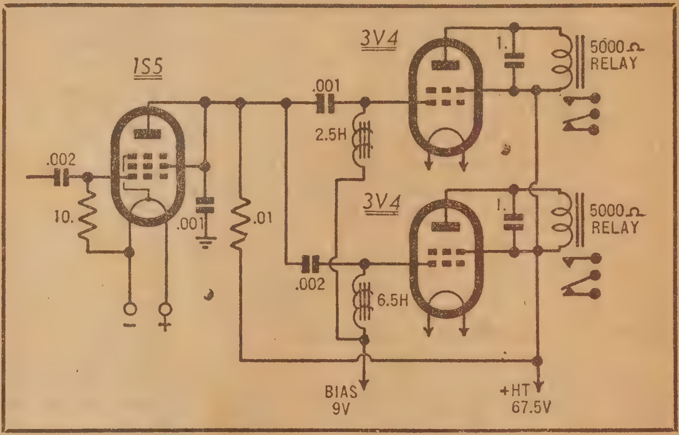

Fig. 18—Two channel tone operated relay stage.

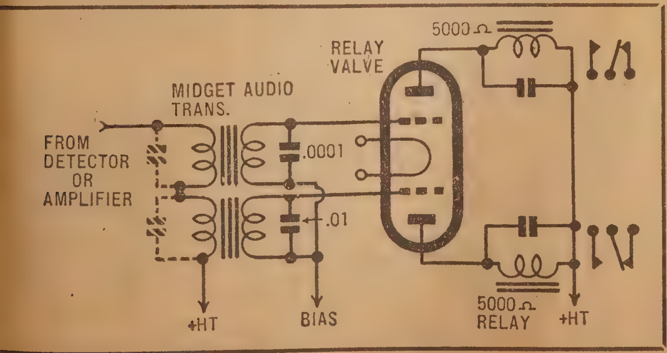

Fig.17—Two channel relay amplifier.

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PF 182	240	12	200	40	12.6V CT @ 1A	33/6
PF 126	240	12	250	60	12.6V CT @ 1A	47/6
PF 146	200.30,40	12	325	150	12.6V CT @ 2.5A	67/-

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CF 105	15	250	80	24/-
CF 106	12	200	100	24/8
CF 107	30	360	100	34/8
CF 108	12	135	150	35/-
CF 109	20	225	150	37/8
CF 110	12	100	200	43/8
CF 111	16	165	200	45/10
CF 112	10	70	250	46/2

SPECIAL CHOKES

CF 113	.5 20	70	250 50	Swinging choke	50/6
CF 114	1.1	23	375	Ballast choke	24/-
CF 115	.017	.6	2 amps	L.T. choke	10/-

OUTPUT TRANSFORMER TO VOICE COIL

Full Frequency Range (30-15000)

Code No.	Pri. Imped.	Sec. Imped.	Watts	Retail
OP24	5000 SE	8.4, 2.1, with feed back	5	44/10
OP23	3250 SE	12.5, 8.4, 2.1	10	65/1
OP19A	5000 PP	12.5, 8.4, 2.3	15	102/10
OP51	4500 PP	15.5, 12.5, 8.6, 2.7, 2	20	
OP63	10000 PP	15. 3.75	15	100/-
OP64	10000 PP	12.5, 3.125	15	100/-
OP65	10000 PP	8.4, 2.1	15	100/-

OUTPUT TRANSFORMER TO VOICE COIL

Special Full Frequency (20-30,000)

OP25/40	10000 PP	40, 10	15	130/-
OP25/16	10000 PP	16, 4	15	130/-
OP25/15	10000 PP	15, 3.75	15	130/-
OP25/12	10000 PP	12, 3	15	130/-
OP25/10	10000 PP	10, 2.5	15	130/-
OP25/8.4	10000 PP	8.4, 2.1	15	130/-
OP66	5000 PP	8.4, 3.7	15	130/-
OP67	5000 PP	15, 6.5	15	130/-

OUTPUT TRANSFORMER TO LINE—

Full Freq. Range.

OP22	3250 SE	500, 125, 8.3	10	65/1
OP19b	5000 PP	500, 250, 125	15	102/10
OP21	8000 PP	500, 250, 125	15	82/10
OP62	10000 PP	500, 125	15	100/-

OUTPUT TRANSFORMER TO LINE—

Special Full Freq. Range

OP25/500	10000 PP	500, 125	15	130/-
OP25/250	10000 PP	250, 62.5	15	130/-

VIBRATOR TRANSFORMERS

Code No.	Pri. V.	D.C. Out.	MA	Buffer Full Sec.		
VT 100	32	200	40	.005	Sync.	27/-
VT 101	6	90	15	.008	"	19/6
VT 102	6	150	25	.005	"	23/10
VT 103	6	200	50	.005	"	25/-
VT 104	6	250	60	.005	"	37/-
VT 105	12	250	60	.005	"	37/-
VT 106	6	300	75	.008	"	52/-
VT 107	6	250	60	.005	Sync. Low Rad.	30/6
VT 108	12	90	15	.008	Sync.	21/8
VT 109	24	90	15	.008	"	23/8
VT 110	12	150	25	.005	"	23/10
VT 111	24	150	25	.005	"	26/6
VT 112	12	200	50	.005	"	25/-
VT 113	24	200	50	.005	"	26/6
VT 114	12	300	75	.008	"	54/2
VT 115	24	300	75	.008	"	55/6
VT 116	24	250	60	.005	"	30/-
VT 117	12	250	60	.005	Non Sync. Low Rad.	31/-
VT 119	32	150	25	.005	Sync.	25/6
VT 121	6	180	30	.005	"	25/4
VT 122	6	400	50	.005	"	50/-
VT 123	12	320	125	.005	Sync.	63/3
VT 124	32	250	60	.005	"	30/-
VT 127	6	200	50	.005	Sync. Low Rad.	29/8
VT 128	12	250	60	.005	Sync. Low Rad.	38/-

RECEIVER POWER TRANSFORMERS

Code No.	Prim.	HTV Aside	M.A.	Filaments	Retail
PF 185	240	150	30	6.3V @ 2A	24/-
PF 106	240	325	45	6.3V @ 2A, 5V @ 2A	30/-
PF 198	240	285	50	6.3V @ 2A, 5V @ 2A	30/-
PF 151	200,30,40	285	60	6.3V @ 2A, 5V @ 2A	34/-
PF 165	200,30,40	385	60	6.3V @ 2A, 5V @ 2A	34/-
PF 170	200,30,40	285	80	6.3V @ 2A, 6.3V @ 2A, 5V @ 2A	39/10
PF 168	200,30,40	385	80	6.3V @ 2A, 6.3V @ 2A, 5V @ 2A	39/10
PF 130	200,30,40	285	100	6.3CT @ 2A, 6.3V @ 2A, 5V @ 2A	46/-
PF 160	200,20,40	385	100	6.3CT @ 2.5A, 6.3V @ 2A, 5V @ 2A	46/-
PF 152	200,30,40	285	125	6.3CT @ 3A, 6.3V @ 2A, 5V @ 2A	56/-
PF 181	200,30,40	385	125	6.3CT @ 3A, 6.3V @ 3A, 5V @ 2A	66/-
PF 174	200,30,40	285	150	6.3CT @ 2A, 6.3V @ 2A, 5V @ 2A	60/-
PF 175	200,30,40	385	150	6.3CT @ 2A, 6.3V @ 2A, 5V @ 3A	70/-
PF 173	200,30,40	425	175	6.3CT @ 3A, 6.3V @ 2A, 5V @ 3A	110/-
PF 140	200,30,40	385	200	6.3CT @ 3A, 6.3V @ 3A, 5V @ 3A	111/-
PF 171	200,30,40	385	250	6.3CT @ 4A. 6.3 @ 3A. 5V @ 3A	144/-
PF 201	240	225	50	6.3 @ 2A	29/11

LINE TO VOICE COIL TRANSFORMERS

	Pri. Imped.	Sec. Imped.	Watts	
MT111	500	12.5, 8, 2.3	10	36/9
MT100	600	4, 3	15	36/9
MT101	500	15	15	36/9
MT124	600, 500	4, 3, 2.7, 2.3, 2	25	66/-
MT125	600, 500	15, 12.5, 8.4, 6.5	25	66/-

MODULATION TRANSFORMERS

MT118	8000, 6000 PP	10000, 7000 5000	25	85/-
MT119	8000, 6600, 3800 PP	10000, 7500, 6500 5500, 4500, 3500	50	111/-
MT120	500 to 20000 in steps.	500 to 30000 in steps.	50	200/-
MT121	500 to 20000 in steps.	500 to 30000 in steps.	125	276/-

Output Transformer To Voice Coil—P.A. Range

	Pri. Imped.	Sec. Imped.	Watts	Retail
OP1	5000, 2500 SE	12.5, 8, 2.3	10	39/10
OP54	5000, 2500 SE	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	10	45/8
OP39	5000, 2500 SE	15	10	39/10
OP33	5000, 2500 SE	5, 2.7	10	39/10
OP41	5500 SE	3.7	10	46/-
OP53	30000, 20000 14000, 10000, 7000 5000, 2500 PP	2.3	10	36/9
OP2	5000 PP	12.5. 8. 2.3	15	65/1
OP55	5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP3	6600 PP	12.5, 8, 2.3	15	65/1
OP56	6600 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP4	10000 PP	12.5, 8, 2.3	15	65/1
OP57	10000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP5	10000, 6600, 5000 PP	12.5, 8, 2.3	15	65/1
OP58	10000, 6600, 5000 PP	15. 12.5. 8.4, 6.5, 4, 3 2.7, 2.3. 2	15	76/2
OP59	10000, 6600, 5000 PP	15, 12.5. 8.4, 6.5, 4, 3, 2.7, 2.3, 2	25	93/8
OP60	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3. 2	32	116/8

OUTPUT TRANSFORMER TO LINE—P.A. Range

	Pri. Imped.	Sec. Imped.	Watts	Retail
OP1A	5000, 2500 SE	500	10	39/10
OP44	5000, 2500 PP	500, 250, 125	10	47/-
OP34	5000 PP	600, 300, 200, 150, 130, 100 75, 50	15	81/4
OP6	5000 PP	500, 250, 125	15	65/1
OP7	6600 PP	500, 250, 125	15	65/1
OP50	8000 PP	600, 300, 120, 60, 30	15	126/-
OP8	10000 PP	500, 250, 125	15	65/1
OP8M	10000 PP	500, 250, 160, 125, 100, 83.5 71.5, 62.5, 55.5, 50	15	71/3
OP9	10000, 6600, 5000 PP	500, 250, 125	15	65/1
OP10	5000 PP	500, 250, 125	25	81/10
OP11	6600 PP	500, 250, 125	25	81/10
OP38	6600 PP	600, 300, 250, 200, 170, 150, 76, 50, 36, 27, 12.5, 7.5, 3.6, 2.7	25	140/-
OP12	10000 PP	500, 250, 125	25	81/10
OP13	10000, 6600, 5000 PP	500, 250, 125	25	81/10
OP35	10000, 6600 PP	500, 4000, 8.4, 2.2	25	120/-
OP14	5000 PP	500, 250, 125.	32	102/10
OP48	6600 PP	140, 70.	32	117/8
OP15	6600 PP	500, 250, 125	32	102/10
OP15M	6600 PP	500, 250, 166, 125, 100 83.5, 71.5, 62.5, 55.5, 50	32	104/1
OP16	10000 PP	500, 250, 125	32	102/10
OP17	10000, 6600, 5000 PP	500, 250, 125	32	102/10
OP36	3800 PP	17.6	60	108/7
OP28	3800 PP	500, 250, 125	60	108/7
OP61	3800 PP	100, 75, 25, 10, 5, 2	60	133/8
OP37	6400 PP	500, 250, 125	80	150/8
OP49	8800, 6000 PP	500	105	210/-
OP20	11600, 8400 PP	500, 250, 125	150	276/-

ALL PRICES SUBJECT TO ALTERATION WITHOUT NOTICE.

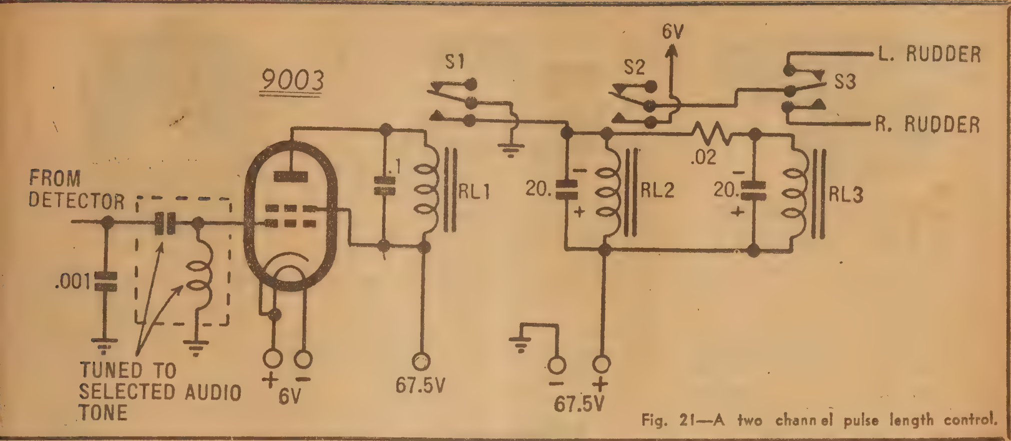

9003
FROM DETECTOR
.001
TUNED TO SELECTED AUDIO TONE
+ 6V −
67.5V
.1
RL1
S1
S2
6V
S3
L. RUDDER
R. RUDDER
20.
RL2
.02
20.
RL3
− +
67.5V

Fig. 21—A two channel pulse length control.

iced into the circuit by the 20mfd ipacitor across RL2. Six volts will ow be applied through S2 and S3 a motor control unit or other actuing device to give rudder left.

The reception of long pulses will gain operate RL1, and S1 will opere RL2, closing contact S2, but this me, due to the longer time-lag introiced by the 20K resistor and the econd 20mfd, RL3 will close as well, 3 change over, and apply the 6-volt r rudder right.

An actuator operated by pulse rate shown in fig. 22.

It consists of a small bar magnet hich slides in a smooth-surface rass tube, a coil wound outside the rass tube forms an electro-magnet. sensitive relay in the receiver folwing the pulses from the transmitr, alternatively reverses the polarity the magnetic field of the coil. The agnet follows the polarity and is rectly connected to the control surice.

To obtain neutral, the transmitter ulse is regulated so that it is "on e air" for the same time interval at it is "off."

To move the control surface the gnal is "on" longer than it is "off," nd the magnet will move harder and nger in one direction than the other.

NTERRUPTER DESIGN

A suitable interrupter at the transitter could be made from a buzzer, odified to work like a vibroflex Iorse key or a motor-driven chopr. Operated by a key switch as a ontrol stick, it is so connected that ill control in one direction would be y steady signal, and in the opposite irection by no signal, and in the eutral or centre position the equal N-OFF signal.

In contrast to the "on-off" system escribed earlier, this one comes earest to being proportional, i.e., the ontrol surface will follow instantly ny movement of the control stick in egree as well as direction, much the ame as happens in a full-size airraft.

True proportional control systems, s a rule, tend to become complicated nd so run to the heavy side, and ould require models very much arger than the aeromodeller could

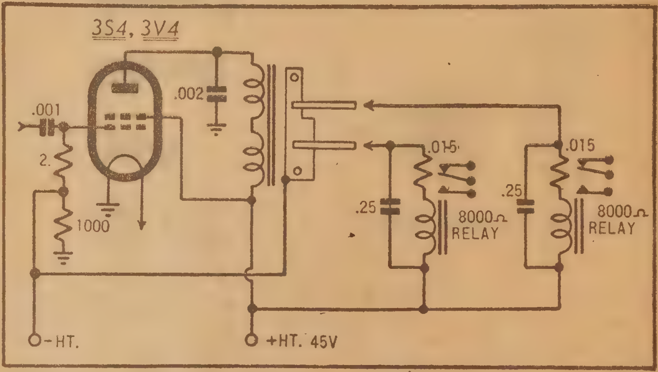

3S4, 3V4
.001
2.
1000
.002
.015
.015
.25
.25
8000Ω RELAY
8000Ω RELAY
−HT.
+HT. 45V

Fig. 19—Two channels with tuned reeds.

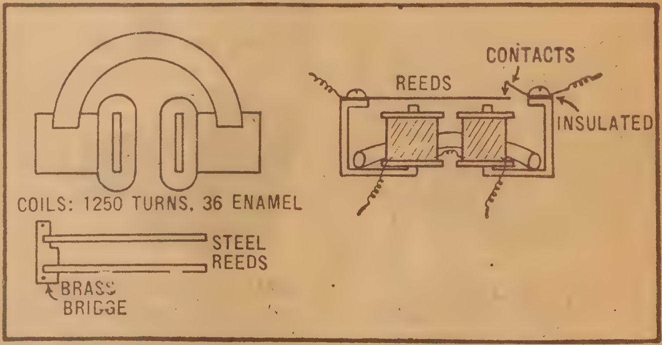

CONTACTS
REEDS
INSULATED
COILS: 1250 TURNS, 36 ENAMEL
STEEL REEDS
BRASS BRIDGE

Fig. 20—Construction of reed selector.

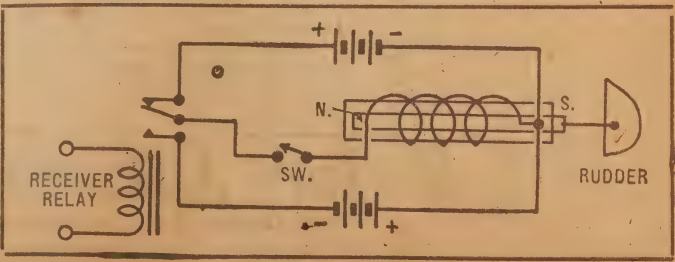

+
−
N.
S.
SW.
RECEIVER RELAY
RUDDER
−
+

Fig 22—Pulse rate actuator.

RIM DRIVE ENGLISH GRAMO MOTORS

Well known make, a really excellent motor.

Price only **£3/15/-.**

Unbranded Sapphire Needles—trailer type. These are as good as any much dearer needle and are thoroughly reliable. Price only **7/6.**

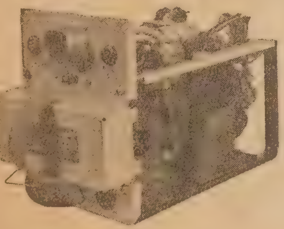
ROLA
MAGNET
WIRE

COIL WINDING WIRE

Silk, enamelled 30 gauge B & S.

3 oz. reel	**3/9.**
4 ozs. reel	**5/-.**

Larger quantities of 36 B & S enamelled wire available in approximately 2 lb. reels. Price **7/6** lb.



POWER SUPPLY for No. 19 Transceiver

Input 12 volts DC.
Output 275 V. 110 MA.
500 V. 50 MA.

An excellent heavy duty genemotor, limited quantity only. While they last. **Price £3/10/-**

BRITISH NAVY CARBON RESISTORS

Assorted bundles, all wattages and values mixed ½ watt, 1 watt, 2 watt, 5 watt, from 10 ohms to ½ Meg. 5% & 10% accurate. An excellent buy while they last. Priced as follows:-

50 assorted	**15/-**
100 assorted	**27/6**
500 assorted	**£6/5/-**

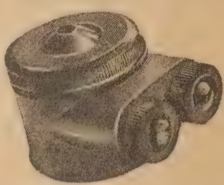
WIRE WOUND RESISTORS

Well-known make. 20 watt available in the following sizes: 50, 75, 100, 125, 150, 175, 200, 250, 300, 400, 500, 750, 1250, 1750, 4000, 7500, 10,000, 12,500, 15,000, 17,500 ohms.

Price only 2/- ea.

25 watt available in following sizes: 50, 75, 100, 125, 175, 200, 250, 300, 400, 500, 750, 1250, 1500, 1750, 2000, 2500, 3000, 4000, 7500, 12,500.

Price only 2/6 each.



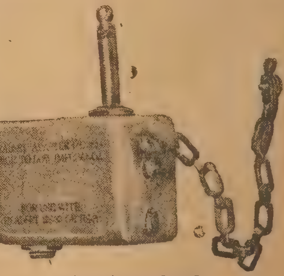
INDICATOR LAMPS

These handy little lamps can be used for indicators on panels, tail-lights of caravans, trailers and bikes, side lights on trucks, cars, etc. An ordinary 2.5, 3.8 or 6.3 can be fitted into the socket and lamp is easily fitted by means of wood screws or machine screws. Available with red or white glass, easily worth 5/- Our Price 2/- — with globe 2/6.

CRYSTAL SET COILS AND PARTS

We are able to offer you completely wound coils for crystal sets. Each one complete with circuit diagrams and constructional details.

Standard type	4/6
Tapped	5/-
I gang Condensers to match	9/11
Ebro Catswhisker type Crystal Detector	3/-
Crystals for same	1/-
Red Diamond Detectors semi-fixed	7/9
Refills for Red Diamond	4/-
High impedance Headphones suitable for crystal sets. Brand New	22/6
Low Impedance phones	8/6
Low to high headphone adaptors	3/9
Metal Spring Terminals	6d



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Low to high Impedance for headphones. Simply plug low impedance phone with adaptor into your phone jack and the results with the low impedance will be equal to high.

Price of adaptor	**3/9**
Low impedance, headphones as new	**8/6 pair.**

NOTICE

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M/S Motor Spares Ltd

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conveniently handle, and for this reason, have not been included.

The very interesting circuit of fig. 23 is covered by a Westinghouse patent and shows the operation of a relay from an audio-frequency pulse.

Part of the audio signal appearing at the anode of the valve is voltage-doubler rectified, and applied as a positive DC to the grid, thus causing the valve to take a maximum current and operate a relay.

At the end of the pulse the charge on capacitor "A" leaks away and the relay opens. A modified circuit of fig. 24 has a tuned circuit consisting of a 5H inductance and a .01mfd capacitor connected in parallel and placed in between the control relay and the anode of the valve.

Sufficient battery bias is applied to the grid of the valve to cut it off. The relay stage is now frequency sensitive and as little as .04v RMS at the correct frequency applied to the grid will produce a rise in anode current to 2.0 mA, sufficient to operate the relay in a positive manner.

An experimental unit using this circuit is shown in Fig. 25. The small relay shown did not prove reliable enough and will be replaced by one of the ex-Disposal types.

ENGINE CONTROL

Model petrol engines unless especially constructed are notoriously sensitive to variation of throttle opening and mixture setting. Radio control of these two is not recommended—instead, ignition control offers an easier solution.

Two-speed timers have been used so that an engine normally running at full speed will change to half speed on the reception of a control signal. A relay in the receiver changes over to the half-speed section of the timer as shown in Fig. 26. This makes a very nice altitude control; the model will probably fly level at half engine speed. This type of engine can be instantly stopped by arranging the contacts of the control relay to open the primary ignition circuit as shown in Fig. 27.

Another ignition cut-out device known as a thermal delay switch, made from a piece of bi-metallic strip, a heater coil and a pair of contacts, as shown in Fig. 28, will, after a pre-set delay period, usually about five seconds, open the primary circuit.

Those who use elevator control would do well to incorporate this delay switch to operate if the elevator "down" signal is applied for too long.

Diesel type engines, on the other hand, can be stopped by arranging a spring-loaded wire, which is tripped by the control relay to either nip a plastic fuel line, thus cutting off the fuel supply, or to allow a plug or flap to close the air intake pipe and so choke the engine to a stop.

There is no particular type of engine to use for radio control work, but on the question of vibration, the twin cylinder engine, particularly the horizontally opposed twin, does appear to offer distinct advantages.

Antennas for use on the two high frequencies do not present any real problem at the transmitter, but on

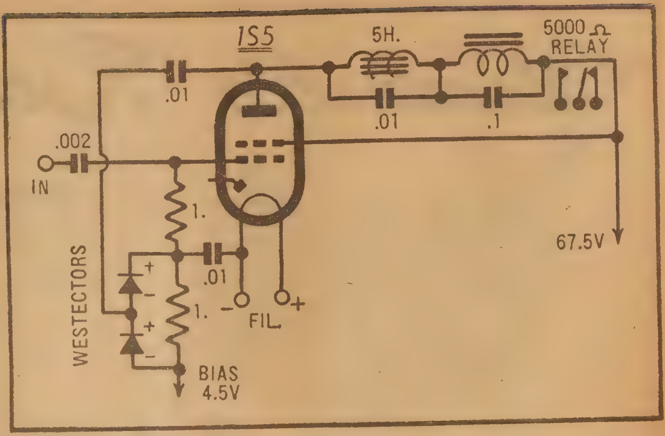


Fig. 24—Modified relay stage, frequency selective.

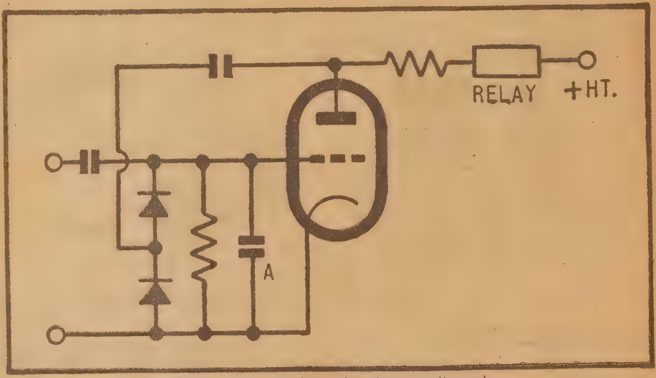


Fig. 23—Operation of a relay from audio pulse.

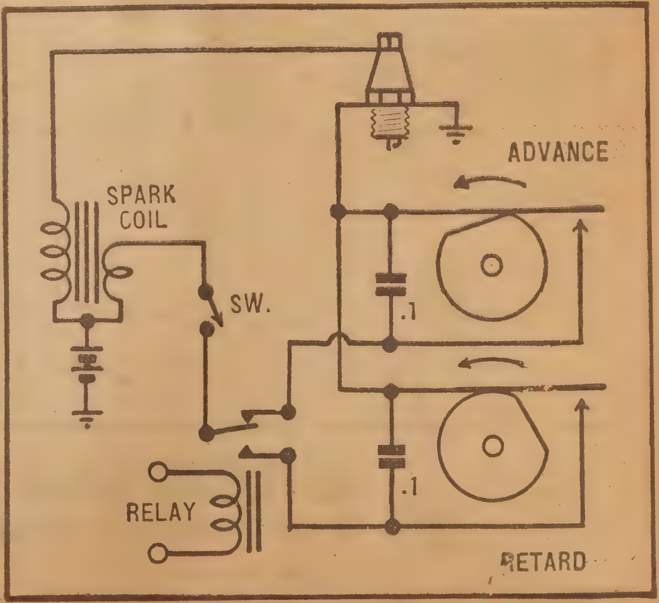
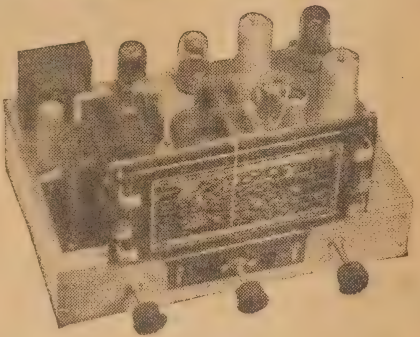


Fig. 26—Two speed timer and relay.

Maxwell's Radio



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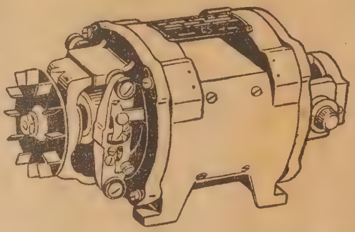

Specifications:

Size 11 x 5½ x 5½ x 1/6 H.P.
240 A/C rating 2600 rpm
240 Volts A/C-D/C 3300 rpm.

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240 Volts A/C-D/C 9/6 extra.

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Can be used between two rooms, sheds, etc., no expense to maintain or run. 7/6 each complete unit, consisting of earpiece, mouthpiece, lead and plug in.

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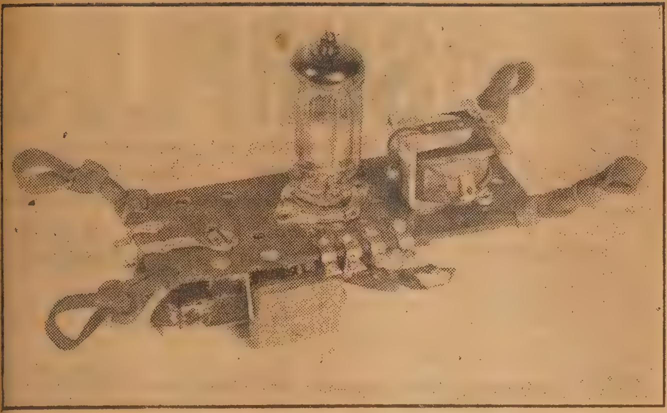


Fig. 25 — An experimental relay control unit

the model a horizontal wire is about all that can be accommodated. If the model has a very large wingspan a doublet can be built into the wings, or, if already made, the antenna could be cemented along either the leading or trailing edge. Otherwise, a single wire from 3in to 5in long run along the wing or from front to rear of the model will suffice, but keep it clear of other wires.

Some overseas enthusiasts appear to be using a vertical whip type antenna at the transmitter and horizontal wires on the model. This results in cross polarisation and will certainly limit the range over which contact is possible. Horizontal doublet, or even a "halo" type of antenna, at the transmitter is to be preferred, even at the expense of portability.

In his third article, Mr. Mills will include some pictures of actual models used in his radio control experiments, together with details of up-to-date equipment. The first two articles, of which this is the second, serve to give the reader an introduction to basic technique upon which later developments are based. The complete series of articles represent possibly the most comprehensive survey of radio control for models yet published.

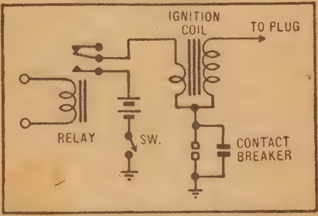


Fig. 27 — Ignition control

The control systems just outlined are by no means the only way to do the job. The reason each system has been described as operating a rudder is for comparison only.

Final details and some later developments will appear in next month's issue.

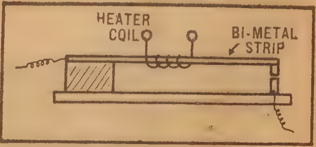


Fig. 28 — Thermal delay switch.

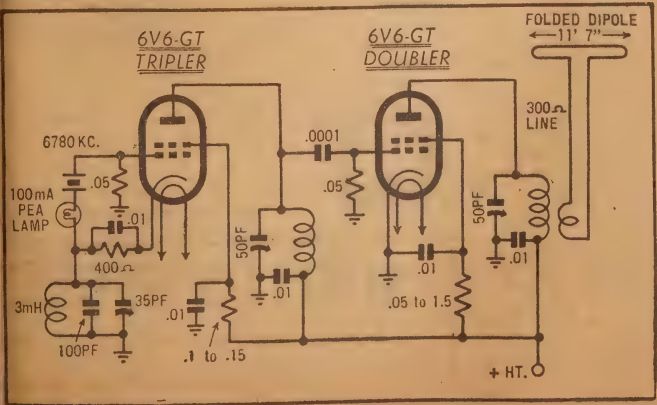
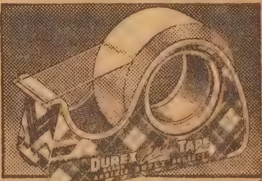


Fig. 29—Crystal controlled transmitter—40.68 Mcs.


Tape it Easy with 'DUREX' TAPE

Hold golf club bindings in place with thin, strong "DUREX" Tape, Then varnish over tape.

Handy Plaid Dispenser with
300 ins. ¾-in. TAPE . 2/6
150 ins. ½-in. TAPE . 1/3
Also a Heavy-Duty Dispenser at 15/- plus tax, and a refillable plastic Hand Dispenser at 3/-, Tape extra.

SEALS WITHOUT MOISTENING
TRADE MARK
DUREX
BRAND
Cellulose TAPE
TRANSPARENT AS GLASS
AVAILABLE EVERYWHERE

Made in Australia by
AUSTRALIAN DUREX PRODUCTS PTY. LTD., Lidcombe, N.S.W.

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Brand New ENGLISH RECTIFIERS

Make yourself a battery charger.

6v. 2 amp ..	24/6
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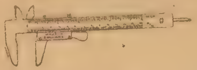
6v. 10 amp ..	57/6
12v. 5 amp ..	57/6

Transformers to suit above Rectifiers, 2 and 5 amp 37/6

BRAND NEW ENGLISH VERNIER CALIPERS

Will measure inside and outside. Can also be used as Depth Gauge.



22/6

Ideal for all types of engineering work. Measures in ins. and m/m. Can be carried in the pocket.

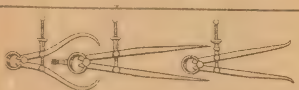
BRAND NEW AIR COMPRESSOR

2.2 cubic feet, will pump up to 75lb.

Never before at this price.

£9/10

Ideal for spraying.



Engineers' Special Outsize Screw Calipers, 4" Dividers and inside Screw Calipers, each 4/6

Nurses' Scissors, large size ..	6/6
Dressmakers' Scissors	12/6 17/6
10in. Tailors' Shears	27/6

Brand New American Weston Voltmeters 0-50V, £2/2/-.

0-50 volts, 0-100 amps, combined. £3/10/-

0-10 Weston Ampmeters 50/-

0-5 Weston Ampmeters 50/-

Also Metro-Vickers 0-15 volts, 0-600 volts, full scale, 0-500 Microamps. Brand New 25/-

A.C.-D.C. 0-20 Milliammeters, 2¾in. dial 23/6

24-volt A.C.-D.C. Geared Electric Motor

100 Revs. per minute.

55/-. Cost £8/10/-.

JUST ARRIVED. Brand New SNAP SHOT CAMERAS, with carrying strap. Special Price 17/6

Cake Mixers, water driven, works off any water tap, as good as electric. Cost £7/7/-. Our Price 39/6

English 150 amp A.C.-D.C. meters, 3½" dial. Ideal for generators. 57/6.

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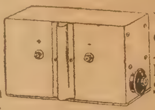
Complete Battery Charger

Fitted with brand new English Selinium Rectifier



Works off 230v. A.C. Household Supply.

Charges any battery from 2 to 6 volts at 5 amps. £5/15/- complete.

BRAND NEW CAR FIRE EXTINGUISHER

Genuine Pyrene. Fit one to your car.

Made in U.S.A. New price £5/10/-

OUR PRICE £3/5/-

Ideal for Trucks or caravans.

Limited Quantity available.

Brand New First Quality English Hand Saws. 26" long.

25/-

4½, 5, 6, 7, 8 and 10 point. Never before at this price. A real Tradesman's Job.

22" Panel Saws, 8 and 10 point, just arrived from England .. 10/6

English 6-Point Kensa Saws, 17/6

IDEAL FOR HOME LIGHTING PLANTS

RAAF BATTERY CHARGING GENERATORS

24 volt 1500 watt £13/15/-

Brand New English Lucas, 12 volt 500 watt £10/15/-

BRAND NEW WESTON DOUBLE READING MILLIAMPMETERS

0-40 0-120, 25/- each.

Perspex Sheet takes the place of glass. Ideal for car windows, etc.

18 x 16 3/32" ..	£1/1/-
24 x 18 3/32" ..	£1/12/6
22 x 14 3/16" ..	£1/1/-
18 x 12 3/6" ..	17/6

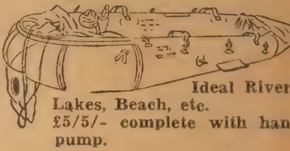
SURPLUS

512 ELIZABETH ST., MELBOURNE, C.

PHONE: FJ5904. Just 4 doors fro

AT LAST AT LAST

RAAF RUBBER DINGHIES



Ideal River Lakes, Beach, etc. £5/5/- complete with han pump.

Invaluable for flooded areas.

JUST ARRIVED ARMY GROUNDSHEET AND CAPE

Ideal for campers, cyclists, hikers

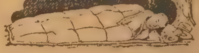
Direct from English Army disposals

16/

Just what you have been waitin for

GUARANTEED WATERPROO SLEEPING BAGS

Why buy a tent for your holiday Ideal for campers. Carry one your car for emergency. .. £4/15



AT LAST. British Army issue DOUBLE SCALE VOLTMETER 0-15 0-250 VOLTS

IDEAL FOR BATTERY SET USERS AND DEAF AID USERS OR HOBBYISTS

CASE FOR VOLTR POCKET 250 V NO 2.
VOLTS

27/

Worth £3/15

SURGEONS SCALPELS

SMALL 4/

LARGE 5/

Many other uses — Hobbyis Chiropody, Photography, etc.

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PLEASE ADD FREIGHT OR POSTAG

Maid Orders Carefully Packe

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512 ELIZABETH ST., MELBOURNE, C.I.
Victoria Street. PHONE: FJ5904

Ideal Motor Mechanics, Radio Mechanics, Engineers, etc., 8/6 each.

Ball and Socket Jointed Inspection Mirror.

Brand New American Vacuum or Air Pump

Builds up air pressure to 30lbs. at 1000 R.P.M. Develops up to 120lbs. per sq. in. of hydraulic pressure, will pump 7½ gals. S.A.E. oil or other liquids per minute. Useful for spraying, milking, presses, oil burners, hydraulic systems £3/15/-

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5 SIZES

English Tweezers	5/6
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Single Drivers, 5 sizes,	2/6 to 3/6
Eyeglasses	6/6 & 8/6
Extra strong double lens eyeglass	15/-

AT LAST: DALTON COMPUTORS. IDEAL FOR AERO CLUBS A.T.C., ETC.

Only Limited Stocks Available. Be Early. 35/-

PHOTOGRAPHIC BROMIDE PAPER—KODAK

Fraction of New Price

5½ x 5½	5/-	per pkt. 144
8½ x 6½	12/6	" " "
9½ x 7½	17/6	" " "
10 x 10	22/6	" " "

Telephone FJ5904

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BRAND NEW CARPENTER'S BRACES

COMPLETE WITH RATCHET BALL BEARING HANDLE "0" SWEEP NICKEL-PLATED MADE IN ENGLAND.

Wonderful Value. Worth 50/-. OUR PRICE, 32/6. BE EARLY.

Genuine Douglas

AIRPLANE SEAT CUSHIONS

CARS, TRUCKS, CARAVANS. CAMPERS' WEEKEND HOMES

Exceptionally well sprung. Many uses.

£3/10/-
COMPLETE
As illustrated

RAAF AIRPLANE COMPRESSOR

Two Stage
Limited Numbers
Highest Quality
£5/5/-

DRILLING OR ENGRAVING HANDPIECE

Brand New . . . . . . 20/- each
Burrs 2/6 packet of 5.

A Lucky Repurchase.

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Brand New Army Phones Ideal for Farms

Install one in your workshop or house. Equal to P.M.G.

BRAND NEW BRITISH METRO-VICKERS

0-1 Milliampmeters
2½" diameter, 32/6

Flexible Silver Cine Screens. 6ft x 42" 12/6
Altimeter or Height Meter. Lots of interest. Fit one to your car 30/-
Brand new £3/10/-

REDUCED PRICE

British Made "Wolf" ¼" AC-DC 230 volt Electric Drills, £15/3/9

Also ¼" Black & Decker 230 volt AC-DC £8/19/6

Never again at these prices. Brand new. Limited Stocks available.

Grinding and Buffing Sets to suit Black and Decker Drills 25/-

THIS MONTH'S BARGAIN LIST

Just arrived American fuel pumps brand new. Will pump any liquid at 400 gals per hour.

American Feeler Gauges	8/6
Dental Inspection Mirrors	5/6
Vacuum Gauges 0.30in.	27/6
Pressure Gauges 0.150lbs.	25/-
Car Type Grease Gun	19/6
12 volt Heavy Duty Accumulators. Brand New, 75 amp	£4/10/-
12 volt, 17 amp Accumulators	39/6
Army Paint, Brown or Buff, Gal.	29/6
Brand New Army Boots, Size 9 only. Pair	26/6
English Spiral Screwdrivers	16/6
Rear Vision Mirrors. Chrome	19/6
Car Tow Ropes, 13ft long	9/6
Gasket or Workshop Snips	4/9
English Barbers' Scissors, Pr.	12/6
Brand New Micro Switches	6/-
Hobbyists Drills, Doz.	6/-
Upholsterers' Needles	1/-
Morse Keys and Buzzer. Ideal for Boy Scouts. Cost £5, for	10/-
Genuine British 4-draw 22 magnification Rifle Range Telescope	£6/19/6
Pocket Compasses, English	5/9
Pocket Telescopes	12/9
Pocket Folding Telescopes, optic glass lenses. Good range	37/6
Workman's Tool Bags, made from solid leather and canvas. Ideal for plumbers or bricklayers. 18" x 8". Each	12/6

Finest Quality Waterproof and Rotproof Tarpaulins.
9 x 9 . . . . £4/10/-
8 x 10, £4/15/-. 9 x 15, £7/15/-. 9 x 12, £5/19/6. 12 x 12, £7/15/-. 12 x 15, £9/5/-. 18 x 14, £13/10/-. 18 x 16, £14/15/-. 20 x 18, £19/19/-. 30 x 20, £33/10/-.

6 x 7 Genuine Japara Covers. Ideal motor cycle covers	37/6
Stainless Steel Pocket Knives, with 2 blades	8/6
American-style Expanding Wristlet Watch Bands, chrome plated	9/6
Gold Plated	16/6

SHORT WAVE NOTES BY RAY SIMPSON

HIGHER FREQUENCIES RAPIDLY IMPROVE

SEASONAL CHANGES TAKE EFFECT

During the past few weeks there has been a marked improvement in signals on the higher frequencies, especially on the 19 metre band. It would appear that the seasonal change is taking place, but until conditions settle down there will still be odd days when signals will be poor.

ON some nights the stations from 15 mc to 15.4 mc are really excellent, the Europeans in particular, such as Norway and Finland, whose transmissions reach real entertainment level and can be followed without any difficulty. Toward midnight, however, the level seems to drop off considerably.

The 16-metre band has not so far shown the same improvement, but no doubt before long we will be hearing these frequencies much better than we have been during the winter months. In addition to these bands, there is the 13-metre band, which is a trifle erratic compared to the 16 and 19, and can at times provide some of the best signals we have ever heard.

The BBC in particular make great use of the 21 mc outlets, and when conditions improve will be heard at excellent strength both at night and also in the early morning. To offset the improvement in the higher frequencies, we must put up with a much higher noise level in the 60 and 49-metre band as the summer approaches.

SOME NEW CALLS

SOUTH AFRICA: The South African Broadcasting Corporation seemed to be somewhat inactive in the way of new stations for quite a long time, but as readers will remember, they have recently commenced operations with commercial programmes on 3.356 mc and 7.295 mc. According to their latest schedule they are now also operating on 3.29 mc from 2.45 pm to 4.30 pm on weekdays and 3.55 pm to 4.30 pm Sundays, also from 2.30 am to 7.5 am daily (Sundays till 7.45 am).

Another new channel is 7.255 mc, Capetown, used from 6.15 pm to 10.15 pm and midnight to 2.30 am on weekdays, while on Sunday they run from 6.15 pm till 2.30 am on Monday. We have not yet been able to log either of these new outlets.

BRAZIL: In last month's issue we made mention of Radio Record and said we thought this was the station we were hearing on 9.605 mc. We have since confirmed that it really is Radio Record, as the call has been heard on more than one occasion around 8 am when strength is quite good.

Art Cushen has also been hearing this station on 6.04 mc until around 1.15 pm, but at this time it is of course not audible in eastern Australia. We gave the address of this one in the September issue and we believe the station verifies, so here is a chance for another good card from a South American. Remember that this station uses Portuguese, though we expect they would understand a letter in Spanish.

TANGIER: The Tangier station operated by the American authorities has recently taken into use another frequency in the 31 metre band. They can now be heard daily on 9.68 mc from 6 am to 7 am; relaying the programme of Radiodiffusion Francais, Paris. Strength of signal is excellent and at first we thought it was Paris, as they do not mention Tangier when closing at 7 am.

Another Tangier station, EA9AA, Radio Africa, which normally broadcasts on 7.06 mc, has recently been heard on 7.1 mc and still more recently on 7.12 mc. The best time to log this African is between 6.30 am and 7 am, and it can easily be recognised by lady and gent announcers.

MISCELLANEOUS: The Bangkok stations have been moving around a lot of late, but at time of writing they seem to have settled on a new channel in the 25 metre band, 11.91 mc, which they use in parallel with 6.01 mc and 15.91 mc with the news in English at 9.15 pm.

STATION ADDRESSES

Forces Station: Stathmos Enopion Dhynameon, 3, Zalokostas Street, Athens, T.I, Greece.
PCJ: Radio Nederland, PO Box 137, Hilversum, Holland.
TFJ: Iceland State Broadcast Service, Reykjavik, Iceland.
Rome: Radio Italiana, R.A.I., Prezidenba, via Botteghe Oscure 54, Rome, Italy.
ETA: Radio Addis Abeba, Press and Propaganda Dept., Addis Abeba, Ethiopia.
ZOY: Broadcasting Department, PO Box 250, Accra, Gold Coast.
VQG: Cable and Wireless, Ltd., PO Box 777, Nairobi, Kenya.
ZUH: Office of the Director, Posts and Telegraphs Dept., Lagos, Nigeria.
FIQA: Radio Tananarive, Office of French High Commissioner, Tananarive, Madagascar.
YDF: Radio Indonesia, Foreign Broadcast Section, PO Box 7, Djakarta, Indonesia.
ZQI: Government Broadcasting Station, 2 Seaview Avenue, Half Way Tree, Kingston, Jamaica.
ZIK2: Government Radio Station, c/o Colonial Postmaster, Belize, British Honduras.
4VRW: Station de Radiodiffusion 4VRW, PO Box A117, Port-au-Prince, Haiti.
PRA8: Radio Club de Pernambuco, Avenida Cruz Cabuga 394, Recife, Brazil.
HJCX: La Vox de Colombia, Apartado 2665, Bogota, Colombia.

Schedules For Holland and Finland

HERE is the current schedule for Radio Nederland and also for the Finnish short-wave stations, which we publish by courtesy of the Universalite:—

Radio Nederland—

8.0 pm to 8.55 pm: To Australia, New Zealand and the Pacific on 15.22, 17.775, and 21.48 mc, and to Europe on 6.025 mc.
3.30 am to 4.25 am: To South Africa, Great Britain, Ireland and Continental Europe on 6.025, 9.59, 11.73 mc.
12.0 pm to 12.55 pm: To USA and Canada on 9.59 and 11.73 mc.
10.15 pm to 1.0 am: To Indonesia and Far East, 17.775 and 21.48 mc.
5.0 am to 7.0 am: To Europe and Africa in Dutch, 6.025, 9.59, 11.73 mc.
9.30 am to 11.55 am: To Suriname and Dutch Antilles, in Dutch, on 9.59 mc and 11.73 mc.
4.30 am to 4.55 am: To South Africa in Afrikaans on 6.025, 9.59 and 11.73 mc.
5.0 am to 5.30 am: To Near East and Egypt, in Arabic, on 9.59 mc.
7.0 am to 7.30 am: To N. Africa, in Arabic, on 11.73 mc.
2.0 am to 2.30 am: To South and South-East Asia, in Hindustani and English, on 11.73 and 15.22 mc.
11.0 pm to midnight: To Indonesia on 15.22 mc.
8.30 am to 9.25 am: To S. America and Spain on 6.025, 9.59 and 11.73 mc.
1.0 pm to 1.55 pm: To Central America and the Caribbean Area on 9.59 and 11.73 mc.

OIX, Finland—

1.0 pm to 2.30 pm: To USA, in Finnish, 9.55, 15.19 and 17.8 mc.
2.30 pm to 3.0 pm: To USA, in Finnish, 9.55, 15.19 and 17.8 mc.
2.30 pm to 4.10 pm: Non-directional on 6.12 mc.
6.50 pm to 10.0 pm: Non-directional on 6.12 mc.
10.0 pm to 10.15 pm: For Europe, in Finnish, 9.55, 15.19, 17.8 mc.
10.15 pm to 10.25 pm: To Europe, in English, 9.55, 15.19, 17.8 mc.
10.25 pm to 11.0 pm: To Europe, in Finnish, 9.55, 15.19, 17.8 mc.
11.0 pm to 11.10 pm: To Europe, in French, 15.19 and 17.8 mc.
1.0 am to 7.0 am: In Finnish on 6.12 mc.
2.45 am to 3.45 am: To USA, in Finnish, on 15.19 and 17.8 mc.
1.0 am to 8.0 am: To USA, in Finnish, on 15.19 mc and 17.8 mc.

ABOUT OUR CORRESPONDENTS

Over the period of years we have been preparing the short wave notes for Radio and Hobbies we have been fortunate in making the acquaintance of a great number of people whom otherwise we would never have met.

THIS, in our opinion, is one of the most interesting benefits associated with our hobby of DX listening. Even though we originally met only as a result of our common interest in short-wave listening, as time went on we have become to know each other better and, I hope, mutually benefit by knowing each other.

As a case in point, while the writer was in Melbourne a couple of years ago, he took the opportunity to meet some of the people who had written letters regarding their station loggings. We still have memories of a very pleasant afternoon spent at the home of Miss Dorothy Sanderson, who is well known to listeners both in Australia and overseas. More recently, when Miss Sanderson was passing through Sydney on her way to Cairns, we had the pleasure of having lunch with her and a general chat on short-wave matters. From time to time we have also met other interstate listeners when they have been in NSW, and the same thing has occurred, we know, in other States when listeners happen to be away from their home State.

Although, unfortunately, we have had no opportunity to meet them, we have also got to know quite a number of overseas listeners through the many letters that have been exchanged. Just a few days before writing these notes we had a very nice letter from a Mr. Jens. M. Frost, of Copenhagen, Denmark, who wishes to become a regular correspondent to our pages. With so much political difference of opinion in evidence, it is refreshing to feel that the average man in the street really wants to be friendly with his counterpart in other countries.

FLASHES FROM EVERYWHERE

CANADA: We have just received an air-mail letter from the Canadian Broadcasting Corporation advising a temporary change of broadcasting hours for their Pacific transmission. As from Sunday, September 17, and for a period of six weeks thereafter, stations CKLO, on 9.63 mc, and CHOL, on 11.72 mc, will open at 3.40 pm instead of 6.40 pm as at present.

This temporary adjustment results from the fact that the telegraphic lines to the transmitter are in need of repair and overhaul, and, as it happens, the most suitable time to carry out this repair work falls in the Sunday period usually occupied by the Pacific transmission.

TURKEY: In the August issue we made mention of the test transmissions being carried out by Ankara on their new outlets in the 31 and 16-metre band. We are now able to confirm that the call letters for 9.515 mc are TAT and, for 17.84, TAV.

We have recently obtained further information regarding these new stations, and it appears that they are of 100 kw and are due to come on the air with regular transmissions on October 29, 1950, operating under one or more of the following call-signs: TAS, 7.285 mc; TAT, 9.515 mc; TAO, 11.88 mc; TAU, 15.16 mc; TAV, 17.84 mc; and TAX, 21.66 mc. No mention is made of TAP and TAQ, so it is not known whether these two stations will continue in use.

RHODESIA: There have been reports of Salisbury operating on 9.89 mc around 6.0 am, this outlet having been heard by Art Cushen. Further information regarding Salisbury shows that they are currently operating on 3.32 mc and are also carrying out tests with a 1 kw transmitter on 9.49 mc and also with an 8 kw outlet on 6.08 mc.

Readers will remember that we recently reported reception of Salisbury on 4.885 mc and also on 6.02 mc, the latter being excellent till closing at 6.0 am. We have always found that the best time to log these stations is from around 5.30 am until 6.0 am, when they leave the air. As they are testing, we know the Chief Engineer will appreciate reports from listeners.

TAHITI: According to the NZ DX Times, Station FO8AA in Papeete advises that they intend to modify the station and before the end of the year will change frequency from 6.98 mc to 7.3 mc and will broadcast in French to Oceania from 8.0 am to 8.45 am and from 2.0 pm to 2.45 pm.

The other Tahiti station, FZP8, "Radio Tahiti," also contemplates changes and states that new studios are being built and new equipment will make it the best standard of transmission in this area. Early next year FZP8 will move from 12.08 mc to 9.053 mc, with a power increase to 24 kw. These broadcasts will be for the USA and will be bi-weekly and perhaps later on a daily basis.

HONDURAS: This is rather an elusive country, though recently there have been excellent signals from HROW, in Tegucigalpa, which station, we now hear, verifies listeners' reports. Another Honduras station, also in Tegucigalpa, is sending out their verification, according to the latest issue of the Universalite.

This one is HRA, which operates under the slogan, "Radio Mil Cien," "La Voz de Lampira," transmitting in parallel on 5.925 mc and 9.035 mc, using an RCA transmitter of 1500 watts. There is another Honduras station which can sometimes be heard around 11.0 pm in eastern Australia, this one being HRN, "La Voz de Honduras," which operates on 5.875 mc.

USA: Verifications from the USA now seem to take much longer to arrive than they used to do, both due to the delay in answering and also to the fact that ship mails are now very infrequent between the USA and Australia. Despite this, however, the Voice of America still send out their usual red white and blue card confirming reception.

NEW STATION LOGGINGS

Call	Kc	Metres	Location	Time Heard
Johannesburg	3290	91.19	Johannesburg, South Africa	6.0 am
EPP	3940	76.20	Teheran, Iran	5.0 am
PRB9	6040	49.67	Sao Paulo, Brazil	1.0 pm
Capetown	7255	41.36	Capetown, South Africa	2.0 am
ZEA	9490	31.61	Salisbury, S. Rhodesia	5.30 am
PRB9	9605	31.23	Sao Paulo, Brazil	7.30 am
Tangier	9680	30.99	Tangier, Africa	6.30 am
APK	11585	25.90	Karachi, Pakistan	10.0 pm
WGEO2	11830	25.36	Schenectady, NY, USA	7.30 am
HS8PD	11910	25.19	Bangkok, Siam	9.15 pm
CSA39	15010	19.99	Lisbon, Portugal	7.30 am
KRCA	15240	19.69	Dixon, Cal., USA	4.30 pm
Honolulu	15330	19.57	Honolulu, Hawaii	7.0 pm
Manila 3	17780	16.87	Manila, Philippines	5.15 pm

VERIFICATIONS OF THE MONTH

DYH4, PHILIPPINES: In last month's issue we listed a new station in the Philippines operating on 6.055 mc under the call letters DYH4. At that time we understood the location of this station was Iloilo City, but we have now heard from New Zealand that Jack Corbett has received his verification from the station and it turns out that it is located in Dumabuete City.

According to their letter their schedule is from 8 pm to 10 pm at present, but we have now heard them till as late as midnight. Power is stated to be 300 watts and antenna a V beam directed on Luzon. We sent our report to Iloilo City, so hope they forward it to Dumabuete City.

PZC, SURINAME: Our old friend Raymond Clack, on seeing our note that this station had again been heard in Australia, sent along his verification, which he received back in 1945. The card is a very attractive one and at the upper left shows a view of the transmitter buildings and masts, while at the right is the red, white and blue Dutch flag.

SHORT Wave Notes for the November issue are due on October 7. For the December issue they are due on November 4. Please send them direct to Mr. Ray Simpson, 80 Wilga Street, Concord West, NSW.

In addition, they show the latitude and longitude, 55.09.13 W, 5.49.48 N, and state that power is 5 kw and beam is directed to Holland. Many thanks for letting us see this card, and you should certainly be proud of it, as Suriname is a hard country to hear, let alone verify. We only hope our own card comes along in due course.

FXO, FRANCE: After having given up hope of receiving a reply to our report of last January we have now received a very attractive card from FXO in Paris, confirming our reception of the station on 20.09 mc. The card shows the call in large white letters, together with a picture of the transmitting panels and control desk, and at the bottom Service des Telecommunicaciones et de la Signalisation de l'Aeronautique Civile, Paris.

On the reverse side it states that the transmitter was made by S. B. Brown, Boveri and Cie in Switzerland and that they use 20 kw, operating within the range from 3.3 mc to 30 mc and that they can change frequency in two minutes.

TGTQ, GUATEMALA: When we wrote to this station we were under the impression that the short wave call was TGTO, but it now appears from their letter of verification just received that this call may be TGTQ. In the printing at the top of the letter they show TGTQ 6285 kc and TGTQ 1470 kc.

In the body of this letter they verify reception of TGTO on 6285 kc, while an impressed rubber stamp at the foot of the letter shows TGTO 1470 kc and TGTQ 6285 kc, so you can take your pick from the above. Letter was signed by the director-general, Jose Monteros L. and they give their address as Radio Internacional, 5a Avenida Sur, No. 9. Guatemala City, Guatemala. The station seems to be affiliated with the International School of South America.

ZHU, NIGERIA: In a recent verification received from the above station confirming reception on 7.255 mc and 9.655 mc we note that they are also using another outlet, 6.035 mc. They give their schedule as weekdays 4 pm to 5.15 pm on 6.035 mc and 7.255 mc and from 9 pm to 8 am on 9.655 mc.

On Sundays they use all three frequencies continuously from 4 pm to 8 am Monday. The 6.035 mc and 9.655 mc outlets have a power of 300 watts, while 7.255 mc is rated at 1 kw. They state that though their programmes, which consist of relays of the BBC and local items, are intended for local reception they have received reports from New Zealand, USA, UK and Sweden. (Art Cushen received his veri some time ago.)

DAMASCUS, SYRIA: This station has again changed frequency, as in a recent letter confirming reception on 7.145 mc they state that they now operate on 6.0 mc, 9.55 mc and 12.0 mc. Schedule is given as Fridays 2.45 pm to 6 pm, 7 pm to 11 pm; daily from 2 am to 8 am; Sundays 2.45 pm to 6 pm and 7.30 pm to 11 pm; and other days 2.45 pm to 4 pm and 9 pm to 11 pm. News in English can be heard from 9 pm to 9.10 pm and from 7.30 am to 7.40 am, while there is European type music from 8.30 pm to 10 pm and dance music from 7 am to 7.30 am. They say that their transmitters are temporary ones of half a kilowatt each, also a new one of 7½ kw.

New Channel For Lisbon Station

PORTUGAL: The Lisbon stations seem to be having a deal of trouble in finding a satisfactory channel in the 19 metre band, as they have now tried yet another, this time using station CSA39 on 15.01 mc, which can be heard both in the early morning and around 10 pm.

Strength of signal is not particularly good as yet, but as the band improves toward summer we think it will give out a good signal. Lisbon has now been heard on this band using 15.01 mc, 15.09 mc, 15.1 mc, 15.11 mc, 15.12 mc, 15.145 mc, and 15.16 mc. Listed calls and frequencies are CSA35 15.11 mc, CSA36 15.12 mc, CSA37 15.32 mc and CSA39 15.145 mc. It is very difficult to follow stations when they wander around the band like this.

U.S.A.: The General Electric Co. station in Schenectady has now been logged on a new channel using WGEO2 on 11.83 mc. The best time to hear this station is from 7.30 am to 8 am, when the programme is in English.

Although not exactly an American station, we list Honolulu in this paragraph, as they carry the same programme as the Voice of America stations. Honolulu has now been logged at excellent strength nightly operating on 15.33 mc, which as far as we know is a new outlet for this station. This station seems to have abandoned the call letters KRHO and KRHK, as in all their announcements now they merely say "Honolulu."

TOOL BARGAINS

"Rabone" 6ft. Steel Tape, 8/6.

Sawspindle, Double-ended, complete with 6" Saw and Emery Stone, Bearings and Chuck, 110/-.

Sidecutters, 5" 5/6; 6" 6/6; 7" 8/6.

Snipe Nose Pliers, 5" 5/6; 6" 6/6.

Snipe Nose Pliers Ins., 5" 6/6; 6" 7/6.

Comb. Pliers, 5" 4/6; 6" 5/6; 7" 6/6; 8" 7/6.

Comb. Pliers Ins., 6" 8/6; 8" 9/6.

Vice Grip Pliers .. 14/6

Gordon Engl. Multigrips, 13/6.

"Bahco" Swedish Crescent Shifting Spanners, 4" 8/3; 6" 10/-; 8" 11/-; 10" 13/6; 12" 17/6.

"Carrington" Engl. Crescent Shifting Spanners. 6" 13/-; 8" 13/6; 10" 17/3; 12" 21/-; 15" 37/6.

Bedford or Gordon Chrome Van. Spanners, O.E., SAE, Whit., 53/6 per set of 7.

King Dick Ring Spanners, SAE. Per Set 103/-

Armstrong American socket set 9 SAE, comprising 13 sockets, 2 braces, rachet, universal extensions, universal and sliding handle, Tool-box £17/10/-

Zircaloy Magneto Spanners, BA .. .. 3/6 ea.

Engl. Stillson Wrenches, 10" 15/6; 14" 27/6; 18" 31/-; 24" 45/- each.

American Chain Pipe Vices, each 55/-.

WATCHMAKER'S SCREWDRIVERS
10/6 Set of 5

SPECIAL
High Speed Drills
1/16" to 1/4"
19/6

American Steel Tapes, 66' 77/6; 100' 98/6.

SAE & Whitw. Stocks & Dies. Prices on Application.

Numberdrills 0-16 on Stand, 61 drills per set, 75/-.

Fractional Drills, 1/16-½ on Stand, 29 Drills per set, 85/-.

6" Jeweller Snips .. 8/6

Gilbow Tinsnips, 10" 10/6; 12" 12/6; 14" 16/6.

U.S.A. Tappet Spanners, 7-16 x 17-32, 6/- each; 5-8 x 11-16, 6/- each.

King Dick Tappet Spanners, 7-16 x ½" SAE, 9/3 each; 3-16 x ¼" W, 9/3 each.

Socket and Ring Spanners, all sizes. Prices on application.

Eclipse Hacksaw Frames. Tubular, 12/6; Flat, 6/6 and 9/6 each.

Stanley ½" Breastdrill, each 48/6.

Stanley ¼" Handdrill, each 24/6.

Stanley Ratchet Brace, each 38/6.

Stanley or Record Spokeshaves, adjustable, each 10/6.

Eclipse Sawset, each 18/6

Circular Saws, cross-cut or rip, 6" 17/6; 8" 19/6.

Hard and S.W. Bits, all sizes, from 4/9 to 8/6 each.

Stanley & Record Planes, No. 4, 48/-; No. 4½, 57/6; No. 5, 62/6; No. 5½, 67/6; No. 6, 69/6; No. 7, 87/6.

EXTRA SPECIALS

ALL-STEEL WOOD-CHISELS, 5/8", ¾", 7/8", 3/6 each

Eclipse or Vanadia Engl. Carbon Power Hacksaw Blades, 12 x 1" x 18g, 10 or 14T. dozen, 7/6.

Engl. Carbon Drills, set of 8, 1-16-3-8 in Oilskin bag. Per set .. 12/6

Pistolgrip Handdrill, ¼" Cap. Each .. 7/6

Engl. Galscutters 1/6 each.

Kelly's Visa Broad Hatchets, 16/6.

RING SPANNERS
S.A.E. Sidchrone. Set of 6, 57/6.
Whitw. Zircaloy. Set of 4, 45/-

"Skimma" Engl. Plasterers' Trowels, reduced from 19/6 to, each 10/6.

Tyzak Tubular Bushman Saw, reduced from 28/6 to ea. 18/6.

Expansive Bits, U.S.A., ½ to 1½" 17/6; 1½ to 3" 22/6.

American Metal-Keyhole Saw, 1/9 each.

Engineers' Hammer, each 3/-.

Hand & Tenon-Saws, each 8/6.

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● THERE IS HARDLY A TOOL WE CAN'T SECURE FOR YOU.

Please Send Cheque, Money Order or P.N., Plus Postage.

SOME SIMPLE THINGS YOU CAN MAKE

(Continued from Page 74)

volt transformers (particularly the high-voltage type) on a d.c. supply.

A jar about six inches tall is used. Across the top is a strip of ebonite to hold the terminals and the inner tube. The inner tube is a silica glass tube six inches long and one inch diameter, in the bottom of which is blown a hole about half to one millimeter in diameter. Two lead plates are the electrodes, the one in the tube being curved into a half-cylinder to fit the test tube.

The electrolytic is dilute sulphuric acid, about one part of acid (by volume) to 40 parts of water.

The test tube must be made of silica glass, as it must withstand a great deal of heat at the hole. However, the preliminary experiments to ascertain the best hole size for the given job can be done with ordinary Monax or sodaglass tubes. (The little burner giving the long, thin flame is suitable for this hole-blowing. Place the tube against the lips, and gently force air into the tube, while playing the flame on the bottom.) When the ideal size has been found, see your nearest laboratory supplier, and get your tube. Most suppliers have burners which they will use to burn through the silica glass for you, if you do not have a very hot one yourself. Get a hole burned equal in size to your specimen (or prototype) model.

HOW IT WORKS

The connections are shown beneath the diagram.

The principle is this: If a current of an amp or so is passed through the Wehnelt jar, a high current density occurs at the little hole, where the acid boils, and a bubble of steam breaks the circuit. Immediately the current is stopped, the steam bubble collapses and the circuit is again completed. The cycle is then repeated. Frequencies of up to 2000 CPS are obtainable. It cannot be used for more than half an hour or so at a time, as the liquid will boil, but for display to a class, or as an accessory to a laboratory, it is excellent.

WARNING! When mixing acid with water, pour the acid into the water, NOT the water into the acid!

Wehnelt jars are fairly noisy things and the flashes of light are fairly brilliant. There is nothing to worry about in this display of pyrotechnics! In fact, as part of a display before a class, it is very effective.

PIX
6D at all newsagents

THE HAM BANDS WITH BILL MOORE

Radio amateurs are to be found in most towns of any size throughout Australia and this has proved fortunate as shown in emergency working. By reason of their location alone, NSW amateurs were recently able to make observations on tests conducted by Professor Bailey of Sydney University.

THE professor, a well-known Radar physicist, was conducting experiments on influencing the ionosphere by pulse transmissions.

A signal was emitted from National Station 4QR on 890 Kc/s and a pulse signal transmitted from the New England University College at Armidale, the latter using pulse modulated frequencies varying from 1385 to 1605 Kc/s during an hour with a repetition frequency of 40, or 200 cycles/sec.

It was anticipated that signals from 4QR reflected from the ionosphere above Armidale, would return in the area Katoomba to Canberra, and that the signal received in this area would be heard with a 200 cycle tone imposed upon it due to the ionosphere disturbance above Armidale created by the high power pulses.

The W.I.A. requested that amateurs in the towns mentioned observe the transmissions and submit reports. 4QR's carrier was transmitted at full power and every five minutes for a period of one minute, the carrier was modulated at 5 per cent with a 400 cycle tone.

Dr. Black, VK2AQZ and Jim Corbin, VK2YC arranged the tests and reports were submitted by Bill Zech, VK2ACP of Katoomba, Jack Young, VK2OY of Goulburn and Arch Cox, VK2GU of Canberra. As anticipated, maximum interference was noted by VK2OY of Goulburn. Reports were also submitted by VK2ANF Lane Cove, VK2WH and VK2AMV of Forbes, VK2QA Nyngan and VK2XO of Bellingen.

Further tests will be carried out. Professor Bailey stated that English amateurs had been of considerable assistance to him in the past, and we are certain that similar assistance will be rendered by their Australian counterparts.

THE R. D. CONTEST

SUPPORT for the Remembrance Day Contest this year was even greater than on previous occasions. The contest is run annually on the week-end nearest August 15, to pay tribute to Radio amateurs, who lost their lives in World War II.

The Remembrance Day Trophy is awarded to the State Division of the W.I.A. recording the highest score.

It would appear from observation that about one quarter of Australia's amateurs were active at one stage or another.

As the final State score depends to a large degree on the number of stations active and submitting logs, it was pleasing to see so many stations active.

The South Australians seemed to be scoring particularly well and a great number were active. Provided they can gather sufficient logs, they should go close to winning for the year.

In NSW, VK2PA, 2EO and 2BN scored particularly well and the average score of the six leading stations in this State should be very high. The number of logs submitted from the State was, however, very disappointing considering the number of stations active.

Under the existing rules there is no chance of either Victoria or NSW winning the contest as the deciding factor is the number of logs submitted from any State. Although either of these States can have the best average of their six leading stations, the multiplier, depending on the number of participants in relation to the amateurs licenced in the State, is difficult to get high enough to give them a chance of winning.

Both these States have approximately 900 licenced amateurs and it would be necessary to have between one third to one half of them submit logs to obtain a high enough score.

In smaller States with say between 100 and 200 amateurs it is far easier to get the same proportion active and submitting logs, and the final results depend on logs submitted, rather than on the ability of the six leading stations.

Simple calculations show that leading stations in smaller States need not score nearly as heavily as those in larger States to win the contest.

Incidently, the initial R.D. Contest was won by NSW under the original rules. However, if the current rules had been in operation that State would have run a poor fifth.

While appreciating that any rules which induce greater numbers to participate are steps in the right direction, it would appear that some adjustment should be made to allow the larger States an opportunity of winning the coveted trophy.

W.I.A. NEWS

THE new secretary of the NSW Division is DX and contest man Dave Duff, VK2EO.

Dave is very well known at home and abroad, and, since the war, one year or other has won every worthwhile DX contest. He is certain to enter upon the job with the same enthusiasm that has marked all his amateur activity. Maurice Butler VK2AAN, the retiring secretary has been forced to relinquish the position due to pressure of business.

The NSW division of the WIA will run during November their annual Field Day at Woy Woy. This day allows members of the Hunter Branch and Sydney and country members to meet, and has proved very popular since its inception, well over a hundred attending on each occasion.

The possibility of a change of venue for future field days will be discussed. It has been suggested by the Hunter Branch that Gosford is more central. The exact date, programme and prizes will be announced later.

An appeal is made to all amateurs, who during the war years managed to accumulate large numbers of crystals, to see if they could find an odd one for the use of emergency nets. Crystals that are on 3501 or 7002 Kc/s official emergency frequencies, or could be ground to those frequencies, would be appreciated.

In these days of VFO operation many amateurs will have a number of crystals that will not be used again. Many emergency net members have gone to considerable expense to equip their stations and the donations of crystals would alleviate some of the expense.

CRYSTALS FOR EMERGENCY

In NSW, crystals could be sent to the Emergency Co-ordinator, VK2HZ, W.I.A., Box 1734, G.P.O., Sydney, and in other States to the emergency officer in that State. Receipts will be forwarded to the donors showing whether the crystal was forwarded to the Hunter Valley or North Coast Net, and to which particular station. Emergency work is one way amateurs can demonstrate their value to the public, and any assistance rendered to nets is a good move.

W.I.A. official B/C's have been receiving more than their share of interference lately due apparently to thoughtlessness on the part of other amateurs. Such interference, generally from interstate, is not of much concern to city members, but in NSW, for instance, Victorian stations interfere badly with others listening in southern NSW, while Queensland stations interfere with listeners in the northern part of the State.

The position of course is not peculiar to NSW. Similar interference is being experienced by W.I.A. stations in other States. For those who are not familiar with W.I.A. broadcasts schedules they are as follows: VK2WI 1100 hrs E.A.S.T., VK3WI 1130 hrs E.A.S.T., VK4WI 0900 hrs E.A.S.T., VK5WI 1000 hrs S.A.S.T., VK6WI 0930 hrs W.A.S.T. each Sunday and VK7WI 1000 hrs E.A.S.T. on the second and fourth Sundays.

All broadcasts are made on a frequency of 7196 KC/s, several stations broadcast on other frequencies simultaneously, but interference is mainly experienced on the 7MC band.

The annual meeting of the Hunter Branch of the W.I.A. was held in Newcastle in September. The election of officers resulted in the re-election of Lionel Swain VK2CS as president and Bob Wilson VK2AFS as vice-president. The new secretary is Harvey Fitten VK2SF and treasurer Bill Plant VK2AMM. These officers are wished every success in their positions.

Visitors to the meeting included State President Jim Corbin VK2YC, State Secretary Dave Duff VK2EO and Councillor Dave Evans VK2AYE. The Hunter Branch has grown rapidly during the last year, and the ensuing years are certain to see further development.

DX AND PERSONAL

ONE intending amateur well in the news of late is Percy Sara, father of the Bellingen quadruplets. Perc, a member of the NSW Division of W.I.A., was shortly to have sat for his ticket, but it seems as if he will be rather busy for a while. North Coast Zone Officer, Crieff Rehalick VK2XO, threatens to produce the QUADS as an added attraction for the North Coast Convention at Urunga next year!

There is a suggestion that VK2QUAD (international regulations permitting) be issued to Perc when the AOCP comes along.

One of Australia's finest workers for amateur radio, Doc Barber, VK5MD, is now President of the South Australian Division of the W.I.A. Doc was Secretary of the Division for a great number of years.

For two decades VK5MD has been a stalwart of the W.I.A. and is to be congratulated on his elevation to the position of President, and also on his election as a life member of the S.A. Division.

Eighty metres has received plenty of support during the past winter and ZM6AA and VK1RB have been supplying some interest in the way of DX. ZM6AA is none other than Noel of VK9NR, Norfolk Island fame. The W's have also been coming through on telephony and CW at good strength.

Amateur stations in Western New South Wales have again been co-operating with the army during the floods in that area. Army "ducks" were operating on rescue and food supply work, and while near Bourke, John Watt-Bright VK2YN maintained communication with them, assisting the operation greatly.

Jack Russell VK2QA did a similar job when they were in the Nyngan area, while Hart Wall, VK2JC, held them in contact on the way across to Nyngan.

ARMY CO-OPERATION

Under similar circumstances, a number of amateurs during the past year did excellent work in providing home stations for army "ducks" operating in flooded areas.

A new one for most is VR1E on Canton Island. (Not the American Canton Island). His full QTH is B. B. Schroeder, c/o P.A.A., Canton Is., Phoenix Group, South Pacific.

Strange as it may seem, YN1AA, after a couple of years, managed to produce some QSL cards, not enough to supply them for all those waiting. He is getting them free, so there is still some hope.

QSL officers never seem to rest. Perc Feeny, VK2HI, who assists VK2YC, was ordered to bed for three weeks. That was no deterrent, as after a couple of days an order arrived for all the NSW cards and Perc sorted them in a day.

OVERSEAS

A NEW world record was established between fixed stations on the 435mc band by G5BY in Devon and G6LK, Surrey. The contact was held for 25 minutes, and the distance covered 161 miles. Communication was established on telegraphy signals 589 both ways, while later telephony was used.

G6LK was using 4.5 watts to a 832A and a 17 element Yagi Beam. G5BY also contacted G5TP at 155 miles, G2XC 132 miles, and G3RI 119 miles. He uses 24 elements backed by a screen reflector.

Generally speaking, conditions that allow atmospheric bending on 144mc cause similar effects on the 420mc band. English amateurs are making an investigation into the variations of bending along similar paths at the same time, on both 144 and 420 mc/s. Ducting and its effects seem inadequate to explain all the results observed to date in the VHF spectrum, especially on distances covered over land

A theory presented suggests that waves are also reflected from atmospheric discontinuities at heights from 1000 to 10,000 feet.

The International Amateur Radio Union Congress held in Paris, saw 14 of the 17 National Amateur societies in Europe represented as well as one delegate from Brazil. President of the RSGB, W. A. Scarr, G2WS, was elected president of the Congress, G6LJ chairman of the Administrative and Legislative Committee, and F8OL chairman of the Technical Committee.

European societies took the opportunity of exchanging views and arriving at concrete arrangements for future activity.

Col. Bric Cole, G2EC, ex SVIEC, and a host of other calls in a letter to QST, presents a most logical statement, pointing out the great need of full support for amateur radio societies.

G2EC has been an amateur for 30 years, and besides, has been associated with the international machinery responsible for frequency allocations for a number of years. He has been, and still is, in a position to appreciate the requirements for future work in the radio amateurs interest. He points out that quite a number of European nations are willing and anxious to cut amateur allocations in the HF spectrum. These nations point out that the amateurs contribute nothing to the National economy, while technical contributions resulting from their activity in the HF spectrum are little or nothing. Unfortunately neither of these facts can be denied.

America is now the leading power, and this country's attitude at the next International Telecommunications Conference will have considerable bearing on the outcome of negotiations on the amateur service. A strong National Society can do much to have their delegation support Amateur Radio, and G2EC expresses the view that the ARRL requires the assistance of every licensed amateur in the US to reach this end.

The same argument applies to every National Society and delegation, and we here in Australia should seriously review the position and afford support as required.

American amateurs are still awaiting their new regulations. There have been oral presentations to the FCC by National Societies and individuals, and it would appear that the main opposition is still again the extra class licence (extra technical and Morse requirements), and the proposal that the lines upon which Amateur Radio will develop will be controlled by regulation.

SILENT KEY

IT is with deep regret we record the passing of an old timer, Gerry Challender, VK2ZS, of Kempsey. He first became interested in Amateur Radio in 1932 while attending Sydney University, and using equipment at the Physics School, operated under the University's callsign of VK2CC.

After obtaining his BSc degree, Gerry commenced teaching, and soon afterwards obtained his callsign, VK2ZS.

Prior to the war he operated from many country towns. Commissioned early in the war as a signals officer in the RAAF, he spent a portion of the war as a signals instructor at Point Cook.

He settled in Kempsey soon after demobilisation, and was especially active on 7mc. He did excellent work in the emergency field during the recent disastrous Macleay River floods.

Gerry will always be remembered as an operator par excellence—one of the finest in Amateur Radio in Australia.

He will be missed from the low end of 7mc.

YOUR OPPORTUNITY —

to join the world-wide ranks of amateur transmitters! The Wireless Institute of Australia holds regular classes in Sydney to assist Sydney and suburban enthusiasts to obtain their Amateur Operator Certificates of Proficiency.

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The World's News

SERVICEMAN WHO TELLS

(Continued from Page 49)

on hand. This is deducted from the £100, leaving a net amount of £50. Other items were rent, advertising, telephone and electric light, amounting to £15. Total expenses for the month, therefore, were £65.

The income you received for the month is entered next. This comprised sales of stock £82, service work £18—a total of £100.

Total expenses were £65; total income £100. The difference of £35 represents your net income for the month.

The next thing you want to know is what the business is worth.

This is set out in Fig. 2, which you can call a statement of worth, but which is more correctly known as a balance sheet. It is headed Liabilities and Assets.

You have £105 in the bank, your stock is worth £50, you have shop furnishings to the value of £30, and £30 worth of test instruments; thus your assets total £215.

When you commenced business, you had capital of £200, and your net income for the month was £35, making a total of £235. Your total assets are £215 — where is the difference of £20. It is accounted for by the salary you have drawn during the month. These details are set forth on the liabilities side of the balance sheet.

CHECKING CHEQUES !

Before we finally leave the cashbook, I want you to be absolutely clear why every individual cheque is entered in the total column in the debit side. This is so because, as I mentioned previously, your cashbook also forms a copy of your account in the bank. Every cheque you draw goes through the bank, but, as far as receipts are concerned, the bank only knows about the total amounts you deposit with it. By entering your cashbook in this way its total columns become a duplicate of your bank account, which you can check with your bank statement at any time.

You have £105 cash balance at the end of October. When you come to enter November's transactions (which will be on the next double page), your first entry on the debit side will be "Nov. 1. Balance brought forward, £105." You will then proceed to record all your purchases, sales, rent, &c. in exactly the same way as we have done during October.

This month we have dealt with all your transactions on a cash basis. That is, we have assumed that you have paid cash for all the goods you bought and for all your expenses. Also that you received cash for all the goods you sold, and the service work you did. If any of your purchases had been on credit, these would have been recorded in a different way.

Our next article will deal with the setting up of a ledger, which is necessary to record credit transactions and which will also save you making out a statement of affairs each month. In the meantime you can purchase a cashbook and commence your bookkeeping right away.

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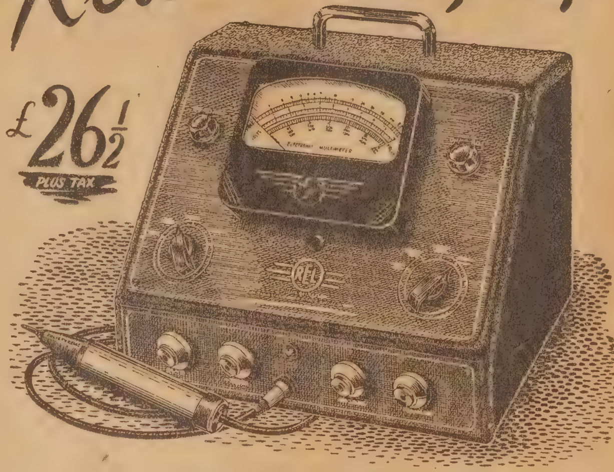

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Quickly it finds the most elusive intermittent, noisy, open or short circuits.

Resistance five ranges, from 0.2 ohms to 1000 megohms.

Accurately calibrated in separate colours on a 4" square dial (mounted in sloping panel) are direct readings on all tests including: All Voltages, Resistors, Condensers, Coils, Transformers, Valves, Speakers, High Resistance Leaks and Faulty Insulation, up to 1000 megohms. Has both internal and external diode.

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0 to 3v 0 to 10v 0 to 30v
0 to 100v 0 to 600v 0 to 1800v

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with internal diode or external probe.
0 to 3v 0 to 10v 0 to 30v
0 to 100v 0 to 600v

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OFF THE RECORD — NEWS & REVIEWS

One of the most interesting things to me this month has been to observe the reactions of Compton Mackenzie in the "Gramaphone" to the recently released Decca long playing records. I had naturally been rather interested in his reactions to LP records, but was staggered to realise that until Decca actually sold them in England, he had never heard one for himself.

By JOHN MOYLE

MAYBE this explains the attitude of "wait and see" which has persisted until recently. To me at least it was enough to hear one side on not very good gear about a year ago to realise that we had here something we have been waiting for for many years.

However, it is only fair to say that Mr. Mackenzie's reaction is quite as definite as my own, and for a conservative and most experienced listener, his comments are enthusiastic in the extreme.

"We have had to wait what some people have thought was an unreasonably long time for the Long Playing Record," he writes in his July editorial, "but at last it is here, and it is really gratifying to be able to affirm that it was worth waiting for. To Decca belongs the honor of being the first to issue it in this country, and if future records are as well chosen and as well made as the first few I have heard, then without doubt a new era for the gramophone has opened."

And with this statement I heartily agree, and so does every one else who has heard the microgrooves I have been able to lay my hands o from time to time.

Mackenzie ranks the introductio of the LP record as comparable wit the advent of electrical reproductio in its importance, and hails Decca' efforts as "jewels." Makes you mouth water, doesn't it? We'll jus have to get hold of records which merit such high praise.

There seems to be a line of thought however, which still favors the 4 rpm RCA type of record togethe with its record changer as being better proposition than the 33 lon players. I have heard this opinio expressed several times when discussing the future with various well-informed people.

CASE FOR 45 RPM

For my part, I find it very har to agree with this idea, although a this stage of the game it is interestin to analyse the pros and cons of it.

I think there might be made a ver good case for the 45 rpm speed in th interests of the highest fidelity. Without wading through a long recital o technical points on which not a grea deal has been published, it seem quite possible that 45 rpm would b preferred among the three presen speeds on this count alone.

Where I feel the 45 records do fal down is that they do not make available the long-playing feature. Certainly the break between records ha been cut down to about three second but the point is that a break is stil required, and in any case, the changer cannot turn records over an play the reverse sides.

As I see it, the only section of th gramophone buying public which i not adequately served at the momen in this respect is that which is interested in hearing the longer work such as symphonies and opera.

MAJOR REQUIREMENTS

Broadly speaking, record listener have three major requirements a far as duration is concerned. Firs of all there are those who desir three-minute performances of song and short pieces at present contained on normal 10-inch record Secondly, there are those who desir to play a number of these in succession—perhaps mixed with an occasional 12-inch side as well. Thi group buys the standard 78 rp record changer, and loads it up wit the required number of records.

The third group is interested i longer works—symphonies, oper and so on. This group has no equivalent of record changing, and eve when automatic couplings are use

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the breaks which occur at the end of each disc cannot be avoided.

Apart from the better quality and silent surfaces provided by the 45 rpm records, plus the more convenient changing mechanism, this type does not offer any of the groups a acility not enjoyed at the moment. n other words, by retaining the 78 rpm speed for these comparatively hort numbers, but pressing them on etter material, there is no real advantage in changing to 45 rpm, alhough admittedly these records are maller and easier to handle.

DD MAN OUT

But I feel that, weighed against he huge number of people who already have 78 rpm facilities and reord changers, it is doubtful whether he change to 45 rpm can be justified n these grounds alone. These records vould, I am sure, prove to be the 'odd men out" just as they seem to e in America.

The only class of listener who is eally inconvenienced under the preent order is the one which listens nostly to longer works. There is othing he can do to prevent breaks n the music at about four-minute ntervals, and even a record changer annot avoid the necessity of getting ut of a comfortable chair to reload t.

Here we have the man for whom omething quite new must be evolved o satisfy his wants. And if it must be ew, with the introduction of a new peed, new pickups, quieter surfaces nd so on, the change must give him verything he wants, or so close o it that it doesn't matter.

As I see it, only the LP record an do this. First and foremost, it llows him to at least play complete novements of sonatas, symphonies nd concertos without a break, and vithout attention to his machine. In nany cases, more than one movenent can be accommodated on a ingle side of a record, which may nake the position even better. But ven when a change of record is equired, there is generally little objection to a short break between the novements, a break which is nornally provided at a concert in any ase, to allow a little mental relaxaion and change of mood.

URFACE NOISE

In the matter of surface noise, here gain, I think the listener to major vorks is more particular. Generally peaking, the demands on dynamic ange and frequency response are nore stringent in such cases than they are for lighter or popular numbers. For this reason a low scratch level is a necessity rather than something devoutly to be desired. And if general recording quality is improved at the same time, we are getting pretty close to the stage at which we can say that results are so good that each successive improvement becomes less important than those which have gone before.

As I see it, therefore, adoption of the 45 standard as against the 33 standard would be only a small step towards solving the problems of that class of listener who now is least satisfied. We can almost equal all the conveniences of the 45 record by improving the 78 standard, which we can scarcely abandon anyhow for many years to come even if we would like to. And as the 33 record seem to have pretty well all the answers for this unsatisfied class, it seems the obvious step to use it.

At the moment, it looks as though it will turn out this way. In America RCA has been forced to adopt the 33 standard, in addition to its own 45 rpm records, or at least, it has done so. But I have not heard of Columbia adopting the 45 standard as well as its own. And in England, the first records of the "new era" to be released are 33 rmp types. It is extremely doubtful whether 45 records will appear at all, and if they do, I think it will be to replace the 78 type, and not for themselves alone. But it would be better to move them all to 33 than to pursue a course which would saddle us with three standards instead of a maximum of two.

NEW RECORDS

Getting back to present day records released here, I have been most impressed with some of the latest of the 78 rpm types. There was a recording of the Schumann piano concerto I heard the other day which really stands out among anything I have seen released to date, and even more impressive, a recording of the Mendelssohn violin concerto played by Heifitz with Beecham conducting.

Apart from the technical excellence of this release, and I thought it quite outstanding, the performance shows how far ahead of his contemporaries is Heifitz as a performer and an artist. So faultless is his playing that musical line and shape materialise like magic almost from nowhere, making even world-famous performers appear in the student class by comparison.

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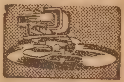

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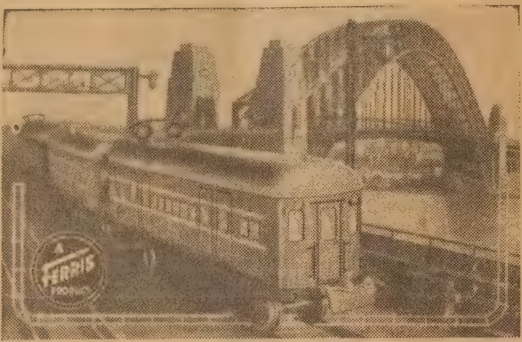

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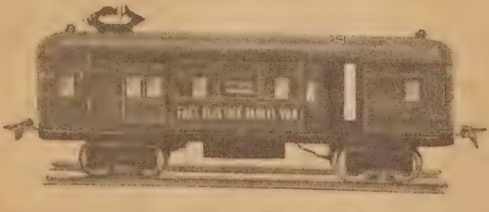

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A COURSE IN TELEVISION

(Continued from Page 51)

grid circuit of the final video stage and direct coupling employed from the video plate to the picture tube grid or cathode.

While figure 2 might infer that the signal is normally clamped to "earth," such is not the case. If necessary, the pulse tips can be clamped to any required potentia in respect to earth, simply by suitable arrangement of the diode return.

The word "clamping" is worthy o note. This apt term has come to be applied quite freely to d-c restorer and similar circuits used in television receivers.

OTHER FUNCTIONS

Inevitably, the urge to simplify receivers has led to the evolution of circuitry which combines the job of clamping with other functions In figure 3, a video amplifier stage is depicted which lacks only in cathode bias components. It is virtually equivalent to figure 3b, which has a diode in parallel with the amplifier tube input.

On a positive-going pulse, the grid tends to draw current in the absence of bias, thereby creating a charge across C, exactly as described for figures 2a, 2b and 2c. It lines up the tips of the timing pulses, as in figure 3b, and thereby acts as it own negative d-c restorer.

The negative-going pulses approaching the white region, are amplified normally, since they carry the grid on to the normal negative grid base.

An important point about this circuit is, however, that the grid must act as a negative restorer, the white pulses being negative-going in polarity.

As with any amplifier, a phase reversal occurs over the stage, so tha the positive-going pulses correspond to white. Thus, the output must be fed to the grid circuit of the picture tube.

CIRCUIT CONDITIONS

Should the receiver fail, or be lef on in the absence of signal, the fina video stage does not generate any bias of its own and draws heavy plate current. Furthermore, should the final video stage fail, there is no voltage drop across its load resistor and a voltage exceeding maximum white is left at the grid of the picture tube. Thus, in two important ways the safety margin on the circuit of figure is questionable.

Considerations of this nature often dictate the use of additional circuitry even in the face of short cuts which would appear to simplify receiver design.

It is not necessary at this stage to examine all the possible variants of video and restorer circuits, bu the reader will, at least, have gained an appreciation of the problems involved.

Let's Buy an Argument

(Continued from Page 43)

FIXED BIAS

Mr. Strantzen raises several intersting points in his letter. The reuirements imposed by fixed bias working do indeed provide an occaional argument for direct coupling. However, I prefer in general to dodge ubes or circuits where this restricive requirement exists.

Of course, there's a lot of erroneous atter in the air about the importnce of fixed bias. As an adjunct o high power, fixed bias is often aluable, but as a necessity for fidelty—baloney! Of course, I do not ccuse Mr. Strantzen of suggesting his . . . he did not.

A couple of his points about peaker loading and damping are pen to discussion, however.

In the first place, no feasible amplifier, not even the Williamson. can damp a loud-speaker as effectively s he suggests.

It might appear at first glance that n amplifier with zero output impedance would give 100 per cent damping/of transient voltages geneated by cone "overshoot." In other words, with a zero impedance amplifier, any conceivable overshoot voltge would develop infinite current nd therefore apply an infinite number of electrical watts to bring the one to rest.

The "fly" in the ointment is the d-c resistance of the voice coil itself, which represents a large proportion of the nominal a-c impednce. This inherent d-c resistance limits the damping current which can low, and the transient response does not show a great deal of improvement once the external damping reistance gets below about half the nominal impedance.

Thus, in this respect, the Williamson amplifier finds itself on common ground with other amplifiers mploying triodes in the output of pentodes with adequate feedback.

RESONANCE

A further fundamental point is that a speaker cone tends to oscillate with greater facility at its resonance requency. Due to the d-c resistnce of the voice coil just mentioned, electrical damping can never be complete, so that some change in acousic output must occur, even though t does not show up on the voltage esponse curve.

The use of baffles producing reonant or anti-resonant effects operte fundamentally on acoustic effiiency involving the cone system, the air column, enclosure volume nd so on. Electrical damping on he speaker has an important bearng on the magnitude of the effects, ut it does not prevent their operaion.

If you are willing to apply this eservation to your remarks, Mr. Strantzen, we will find ourselves in state of blessed and harmonious greement on all points.

The same remark, I'm afraid, applies to Mr. Murden. Of course, the istener is right, like the proverbial customer. If he likes his music "mellow," there's no moral or civic law in existence which can deny him that right. In fact, there's plenty of good psychology behind the preference.

If music is wanted as a dinner background, there's only one answer —"sweet and low." If it's wanted as a background to chatter, it must be muffled and dull.

Contrarywise, music must be dynamic and dominant if it is to exist in its own right. It will make emotional demands quite apart from any thought of distortion, &c., and pity help the out-of-the-mood listener who happens to be within earshot.

WHAT'S THE AIM?

But, even beyond all that, we still have to define our ideas of reproduction. What is the aim of it all? Is it to re-create the atmosphere of the concert hall or is it to produce a pleasing rendition of a familiar work?

There are all kinds of difficulties to the first. The microphone hangs up over the orchestra and therefore "hears" the performance differently from any listener in the hall. There are all the familiar electrical difficulties and the limitations of the room in which the end result is reproduced.

But, given all that in, plenty of folk make valiant efforts to get as close to the original as possible, even though the efforts are despoiled by spurious quanta that have no place in the original.

Others, however, won't have noise or distortion at any price. They are quite prepared to damp down the fiddles, or eliminate the triangles, or do anything else which will produce a smooth, sombre, easy-going version of the particular work.

In other words, their amplifier is not just a reproducer—it's a musical instrument which can impose on a work the particular quality the "player" desires.

So here's a real argument for you lovers of the abstract. Is an amplifier to be designed as a reproducer or as an instrument?

As for the Editor's reference last month to "triodes versus pentodes," I am shamed that he should trot out such an obvious red herring. It shall be treated with the ignore it deserves!

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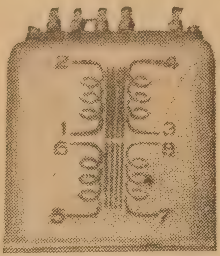

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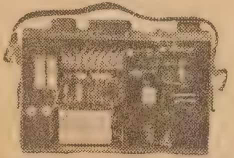

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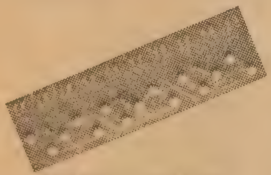

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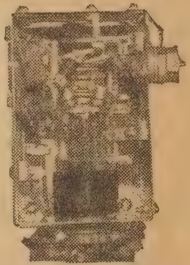

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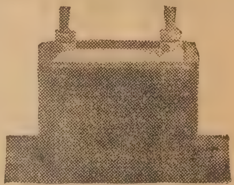

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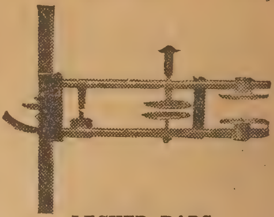

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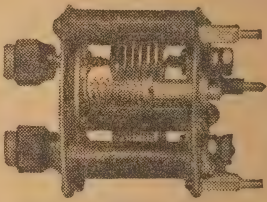

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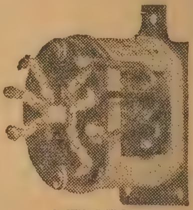

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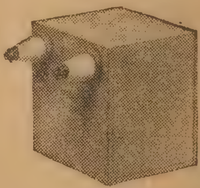

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ANSWERS TO CORRESPONDENTS

J.H.W. (Seaford) suggests that some 3 RPM synchronous motors can be made o run at reduced speed by making up low frequency oscillator using a pair f power tubes.

A. Thanks for the letter and we must onfess that we had not seriously enertained this possibility. However, there re not very many of the synchronous ype motors in use in this country suitble for such treatment. Many of them, urthermore, might not operate properly ith such a drastic reduction in freuency. We can foresee all kinds of ifficulties in getting the oscillator circuit perating properly, and in stable fashion. s these slow speed discs require exremely good speed regulation. In all, e tend to regard the idea as an ineresting one for pure experiment and or those who have the necessary parts n hand. We would be loth to recomend it under other circumstances.

J.E.W. (Dubbo, NSW) says he appretes particularly the record review olumn and makes some suggestions about ems he would like to see covered.

A. Your letter has been brought to e notice of the editor, who writes ese columns and he will, doubtless, make ppropriate comment.

H.C. (Cobden, NZ) is very interestd in microgrooves and says that the nglish Decca releases are due on the ew Zealand market in November. He ays, in the meantime, that some of the atest ffrr 78 rpm discs are very good ndeed.

A. Many thanks for your interesting etter and we agree that some of the atest releases are far ahead of earlier fforts in the 78 rpm field. However, e microgrooves offer the same improveents, plus lower noise level and long laying characteristics. Best of luck with our experiments in the pickup field.

E.N.B. (Sandringham, Vic.) suggests at Calvin Walters made an incorrect tatement to the effect that silver disolved in nitric acid produced nitrous xide — the harmless "laughing gas." ctually, the heavy red fumes are nitroen peroxide and are poisonous.

A. Many thinks for your letter and e are publishing the essential points f it for the benefit of other readers. We have passed it on to Mr. Walters in he meantime Glad you like reading Radio And Hobbies.

J.L. (Bendigo, Vic.) has a genemotor which delivers 500 volts at up to 140 mA. He wishes to use it to operate a eceiver which requires 250 volts at 70 mA.

A The set should operate quite okay rovided you include the necessary dropping resistor which, as you have observd, works out at 3500 ohms. However, part from the very high primary curent required by the large genemotor, the nterference problem is likely to be reater than would normally be expectd from a smaller unit. The large genenotor may be of value to some amateur who is interested in mobile transmitting, o that it may be possible for you to rrange a swap by advertising in the ppropriate columns.

D.A (Snug, Tas.) forwards for comment he circuit of a device for feeding a ickup into the early stages of a superet receiver.

A. While we agree that your idea is ather ingenious, D.A., we feel that it as a novelty value only. The diffiulty of arranging the circuit as you uggest and making it work correctly vould be greater than that of providing n extra audio stage. Furthermore, the eproduction would be subject to the nnecessary limitations of IF channel, ogether with modulation and detector istortion, &c.

P.R.P.W. (Seaforth, NSW) asks us to orward details of the photo timer which vas published in the Reader Built It ection recently.

A. We regret that this information was ot filed at our office and therefore, we annot help you directly. Due to the ulk of the material we find it impossible to file more than standard circuits which have been tested in our own aboratory. However, if you care to write to the Public Library, they will prepare a photographic copy and post it to you. Address your inquiry to the Principal Librarian, Public Library of NSW, Macquarie Street, Sydney. The charge is 1/- for each 10" print with a minimum charge of 2/-. Postage costs 3d extra or 6d registered. The information you require will be found on page 61 of the June, 1949, issue.

J.H (Gunnedah, NSW) thanks us for information supplied through the post and says that it was most helpful.

A. Thanks for your letter, J.H. It is quite encouraging to receive one in this strain, particularly in view of the effort that is necessary to keep track of the incoming mail. Thanks also for the gesture and your wishes in this respect have been carried out.

L.L.B. (Corinda, Qld.) tells us in a recent letter of the success which he had with the Ferrotune Three Receiver which was described in the March, 1947, issue of Radio And Hobbies.

A. Thanks, L.L.B., for your letter and remarks on the performance of this set. The degree of selectivity which you are able to obtain will, no doubt, be due to the comparatively short length of aerial which you say you have used or are using. The fact that you can receive the nine local stations at a volume comparable with a larger commercial set is a good commentary on your location and the driving sensitivity of the EL3NG output valve.

G.D.G. (Ipswich, Qld.) writes in appreciation of the information which, he has been able to obtain from the magazine and the Query Service. He lists his construction of sets as the 1Q5-One, the 1Q5-Two and a two valve set for headphones. This group was later followed by the Fireside Five and the R & H Carry Set. In all cases he says that he obtained splendid results.

A. Many thanks for your letter outlining your activities in the construction of sets described in the magazine, G.D.G. We are particularly pleased with your success with the Carry Set in view of your mention in your letter that you are almost a beginner in radio. Your effort on the Carry Set certainly marks a step forward from what you call the "beginner" stage. We see no reason why this set will not continue to provide you with the entertainment and satisfaction which you are at present experiencing.

YOUR QUERY?

1. Queries will be answered in rotation through the columns of our magazine if not accompanied by a fee for a postal reply.
2. Queries, neatly and concisely set out, will be answered by mail as quickly as possible if accompanied by 1/- in postal notes or postage stamps. Endorse envelope "Query."
3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."
4. Blueprints of exact size chassis layouts with all essential holes, and cutouts will be supplied if available for 2/6. Endorse envelope "Blueprint."

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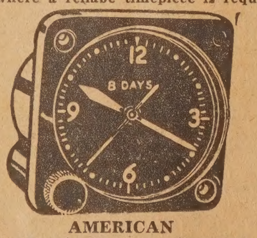

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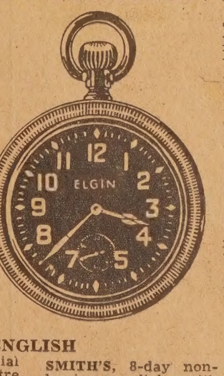

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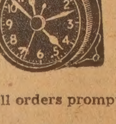

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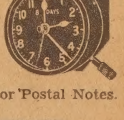

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A 32-VOLT VIBRATOR SET

(Continued from Page 59)

The common earth point on the chassis for the earth lead from the vibrator case is located near the fuse mountings and about a couple of inches from the rear. It's not very important where this point really is, but once having selected it, earth the capacitors of the low and high tension frequency filtering at that point as well as the incoming 32 volt negative lead and the earth lead from the vibrator case. The earth side of the 6RA6 heater is taken to the chassis immediately at that valve socket.

Tag mounting strips are very convenient for mounting of small components and will be found quite helpful in your wiring-up. Try to think ahead with the wiring and thus arrange for the components to fall into their logical place.

The shielded hook-up wiring in the diode and first audio circuits is conveniently arranged by suspending it between the volume control lugs and a three-tag mounting strip on the rear inside face of the chassis. Two of the three runs will stretch right across the chassis with the third one dropping down to the cathode pin of the 6AR7-GT. The shield braid is earthed at one point only, that being around the 6AR7-GT or the 6SJ7-GT socket.

FINAL POINT

A final point on the wiring, and one which is rather important is that the lead from the front section of the tuning gang to the "G" pin of the aerial coil should be run along the top of the chassis dropping down through a hole near the "G" pin. This is to prevent unwanted coupling between the grid and plate leads of this stage.

When the set is completed and switched on for the first time, all that should be necessary is alignment of the tuned circuits. If you follow the technique illustrated in this set you should not encounter any trouble from "hash" interference. If you run into any interference from the 32 volt generator plant, treat the problem in the manner outlined toward the end of the article on the 32 volt Receiver in the January, 1950, issue.

As usual, the alignment is quite straightforward, particularly if you have or can gain access to a service oscillator. However, to avoid repetition in detail in the description of each set we describe, we have available through the 1/- Query Service, a pamphlet entitled How To Align A Superhet Radio Receiver. Briefly, the golden rule in circuit alignment is to adjust the coil slugs at the low frequency end of the dial and the gang trimmer capacitors toward the high frequency end. The padder or oscillator slug sets the position of the stations at the low frequency end and the oscillator trimmer sets them at the high frequency end.

Readers say:

32-VOLT RECEIVER

I built the 32-volt receiver described in your January issue and have had it in operation for nearly five months.

The set has remarkable sensitivity and will play any station that can possibly be played.

A 12in Rola speaker on a 30 x 30in masonite baffle ensures ample volume and good tone. I believe this set is even better than you, the designers, realise. The automatic volume control is excellent. (R. Teasdale, Rupanyup, Vic.)

KIT No. 1.

I have the greatest of pleasure in writing to you about the July issue of Radio and Hobbies Broadcast Five. I have just completed this set and it's a beauty. Can recommend and guarantee that circuit. I can get any station from 2CG and 2CA, Canberra, to the nationals of Western Australia, and also the Dutch East Indies, Indonesia and the American Forces Programme.

I should say off-hand that its B/c range is 1500 to 2000 miles. Perth 6WA, 6WF come in at 11.30 pm (Eastern Aust. Time) equally as strong and clear as 2FC.

However, I have one small fault, the 1 Meg. tone control when operated at any more than quarter volume, gives a continuous rush and a loud squeal or whistle; circuit has been carefully made, checked and rechecked. (T. E. Wyndham, Canberra, ACT.)

* * *

Apparently this correspondent has run into some trouble with audio oscillation. Make sure that the volume control leads have been shielded and the braiding earthed. Try twisting together the leads to the tone control and see that the plate lead of the output valve does not wander back past the pickup terminals. We suggest also that you install a 0.1 mfd. bypass from the B-plus line to chassis, in case the final filter condenser is not acting as an effective RF bypass. This component is usually included in a superhet as a matter of course.

* * *

AMPLIFIER DESIGN

I should appreciate brief answers to the following queries: 1. In a recent edition, an article by J. Moir, reprinted from Wireless World on the subject of speaker damping, states that, for effective damping, input impedance should be between 20 and 50 per cent of the voice coil impedance. If a speaker with an input transformer designed to match it to a 10,000 ohm input were in fact excited from 5000 ohm source, would this achieve the 50 per cent referred to above? If the answer is yes, then the principle is clear to me. If no, a few words of explanation would be helpful.

2. Does the application of inverse feedback to a tetrode actually reduce output impedance? If so, by how much would the usual feedback loop from one of a pair of 6V6's back to the voltage amplifier screen reduce the 5000 ohms per valve output impedance? I know that the transient response is improved, but can't remember why.

3. In a recent issue it was mentioned that the Rola people are about to launch a new speaker considerably better than the 12-0 and yet not much more in price. I have to buy a new one and was going to get a 12-0 but the new model seems worth waiting for. Is there any further news of it?

4. It seems to me that in the Off the Record section you have a definite aversion to crystal pickups, demonstrated by a complete absence of any reference to them, even for purposes of comparison. Why is this? How about a few comments now and then. (E. Hough, Lakemba, NSW.)

* * *

The first suggestion is correct. In other words, for adequate damping, an output transformer designed for 10,000 ohm input would need to be fed from a source having an effective impedance of from 5000 to 2000 ohms—or lower if you like. Owing to losses in the transformer, it is wise to keep below the 5000 limit, if possible.

The plate resistance of a power triode is usually between one-third and one-half its recommended load resistance, so that good damping is assured. A "straight" pentode or tetrode has a very high plate resistance so that the natural damping is very poor. The application of feedback, usually with a gain reduction factor of about three times, reduces the effective plate resistance to the same order as a triode, thus obtaining equivalent damping and, at the same time, preserving the inherent high plate efficiency of the pentode or tetrode.

The new Rola speaker is apparently not yet available for general distribution, but it has certainly not been dropped, as the delay might suggest. It should be worth waiting for.

Most crystal pickups to date have landed in the medium fidelity class and have therefore not figured large in association with high fidelity equipment. However, we like the new Acos GP20, since it appears to combine good quality with simplicity of application and good mechanical characteristics.

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ANSWERS TO CORRESPONDENTS

R.E.B. (Kent Town, SA) sends along several bouquets covering R & H articles, but says that he is most interested in VHF equipment and hopes one day to have his "ticket."

A. To judge by the tone of your letter you have made good use of your association with amateur friends and should not have much trouble when you are old enough to take your ticket. Our suggestions about the 7193 were not based on actual experiments and you may be quite correct in your statement about their limitations. However, VHF super-regen. receivers are very tricky devices and results may be ruined by effects which are apparently external to the tuned circuit. Even the placement of things like the output transformer can make all the difference between stable and unsatisfactory operation.

The point in saying all this is merely to suggest that certain valves and circuits should not be condemned because a particular example refuses to operate properly—it may be purely a special case. We have had the 7193's operating nicely to 288 mc in a transmitter. It is possible that a grid resistor higher than the recommended value might increase RF output in some cases. Never having run a pair of these valves to destruction, we are not sure of their capacity to withstand overload. Best of luck with your current studies.

C.H. (Yarraville, Vic.) sends in the circuit of an amplifier for comment in the columns.

A. Many thanks for the circuit and we have duly filed it for future attention. There are a few points about the circuit which can be discussed with profit to other readers.

E.J. (West Hobart, Tas.), kindly dropped us a line pointing out an error which appeared in the circuit diagram of the Super Eight of the July, 1949, issue and of the Australian Shortwave Handbook, 1950 Edition, Page 52.

A. Thanks, E.J., for your letter. We immediately checked your findings and we agree, with full apologies, that you are correct. Although diagrams are subjected to fairly thorough checking before publication, there are odd occasions where, strangely enough, the simple slips sneak through. The following is the necessary correction. In the converter oscillator coil switching, the upper ends of the windings, that is, the lugs marked "G" and "P," of the broadcast oscillator coil should connect to the positions 1 on deck 3 of the wave-change switch instead of positions 2. The corresponding lugs of the short-wave oscillator coil should connect to positions 2 on deck 3 of this switch instead of positions 1. Positions 2 and 3 remain bridges together as shown. This amendment brings the oscillator coil switching into line with the aerial and R.F. coil switching.

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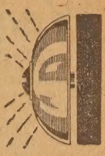

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SALE: New partly assembled 32 volt receiver, complete set of components, has 7 valves, console size, £18 or nearest offer. **J. Rowntree, Romani, Mt. Hope, N.S.W.**

SELL: Axiom 12 spkr. with vented enclosure, £14. Red Line power trans. 450v 200mA, 50/-, and 25H, 175mA filter choke, 20/-. Call (Sat. only), **16 Cambridge St., Enmore.**

SELL: 15 watt Amplifier with inbuilt Radio tuner, 3-12" spkrs., 2 mikes, 2 flares, Stromberg-Carlson Record Changer, as new. Best offer. **UA3271 after 5 p.m.**

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SUNSPOTS AND DAILY LIFE

(Continued from Page 15).

correspondence between the sunspot cycle and the plentifulness of certain fish such as cod and mackerel. He also showed a remarkable correspondence in the number of rabbit skins delivered to the Hudson Bay Company. He found that from 1850 to 1900 the greatest number were delivered during the period when the number of sunspots were at a minimum. This is the opposite to the growth of trees when growth is favored by a maximum of sunspots.

It is now being thought that cycles in nature have an effect on the recurrence of epidemic disease. Although these seem to vary somewhat in periodicity there definitely seems some relationship. There is a ten-year recurrence of meningitis and a seven-year period in diphtheria and influenza. Poliomyelitis is also a disease showing distinct periodic characteristics.

An ingenious instrument devised by a Dr. Burr, of the Yale University, proves conclusively that the delicate electrical balance of the living cell is affected by changes in environment.

As everything on this earth is living in an electrical field extending from the earth in all directions, and as this field is responsible for the electrical potential in the atmosphere in which we live, it is obvious that any changes in that field must influence the electrical fields of the living cell and in turn the actual behavior of that conglomerate of living cells which is the human being. There are great changes in the electrical fields during sunspot cycles.

The cyclical character of economic conditions has been a subject of discussion for many years. Booms and busts, prosperity and poverty go in cycles as everyone knows.

Certain it is that prosperity depends largely on agriculture and weather conditions govern agriculture. It has been contended as early as 1878 by W. S. Jevons that there is an average of eleven years between economic crises and this corresponds to the sunspot cycle.

Dr. Ellsworth Huntington, of Yal University believes that changes i the sun affect human health and behavior. He asserts that mental attitude depends upon health, a statement with which everyone mus agree.

The idea, therefore, is that business cycles follow cycles in huma behavior and consequently they als follow the psychology of the mas of the people which is in turn influenced by the changes in the electrical potential of the earth's atmosphere from time to time.

A chart recently published i America shows that the busines panics of 1912, 1923 and 1933 abou corresponded with the years c minimum sunspot activity, while th boom years of 1907, 1918 and 192 corresponded with the years of maximum sunspot activity.

Maybe there is something in a this and it will be interesting t note what happens when sunspot again reach their minimum activity

Meanwhile our taxes must be pai The electric light and gas bills com in, the prices of essentials such a beer and tobacco soar to height which almost make one "give the away"—again. My 1928 car is onl worth £20 but I can get £100 for i My house is worth four times a much as I paid for it twenty year ago. I have a fortune in assets bu no ready cash because it costs twic as much to live as I get, yet I manage to get along. I can't work i out. Boom or bust, I don't kno what it is. Sunspots maybe. S what.

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